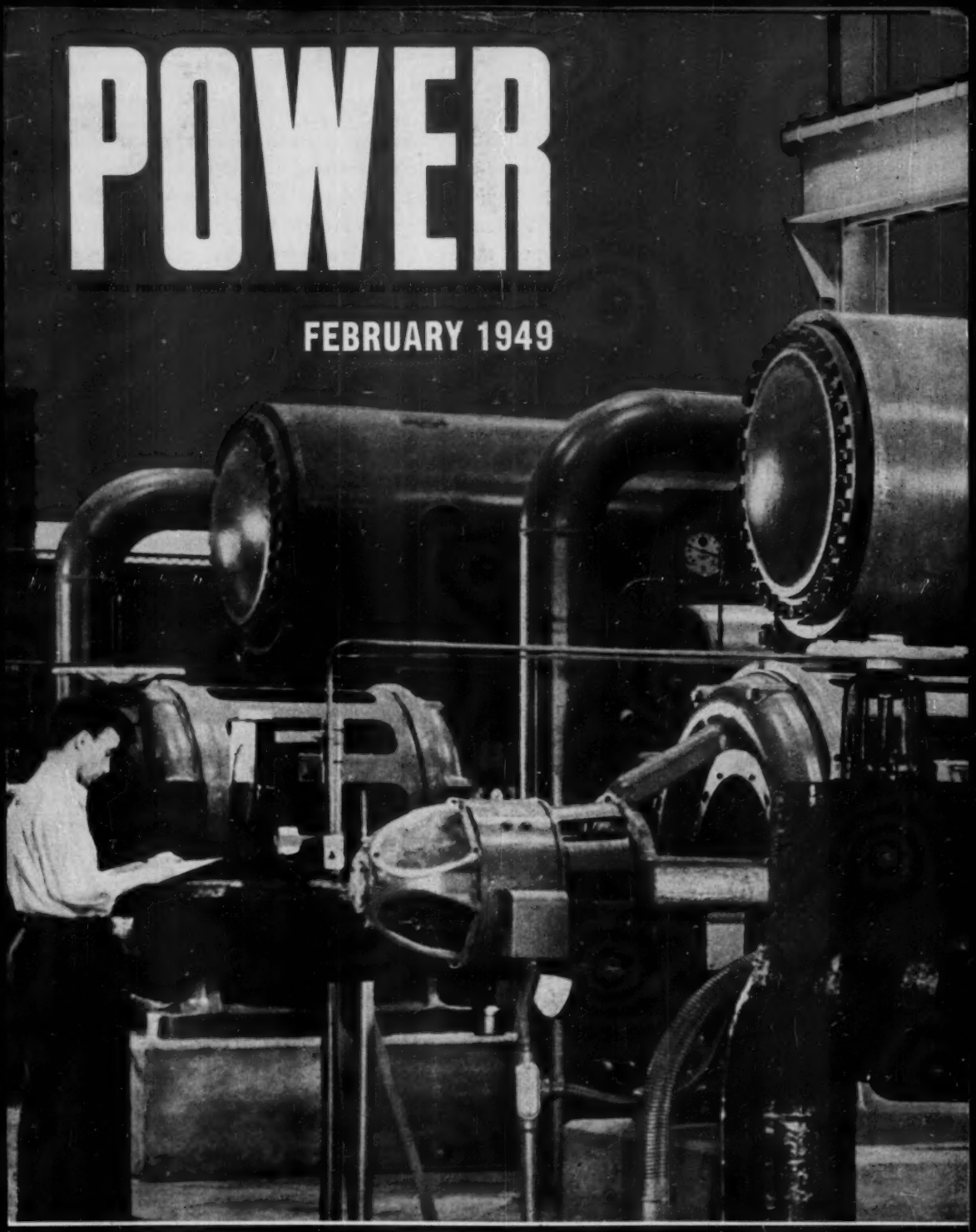
POWER

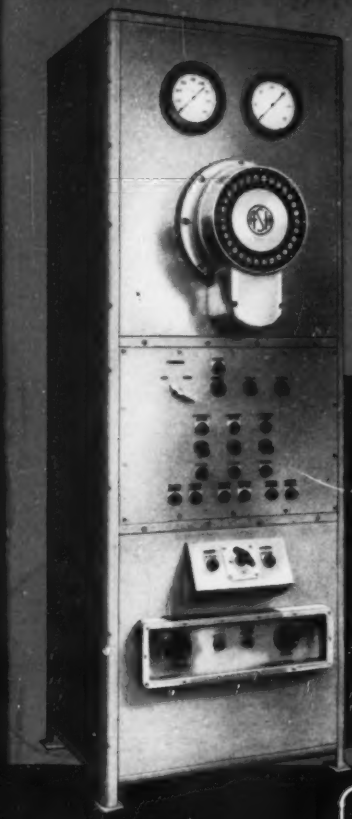
FEBRUARY 1949

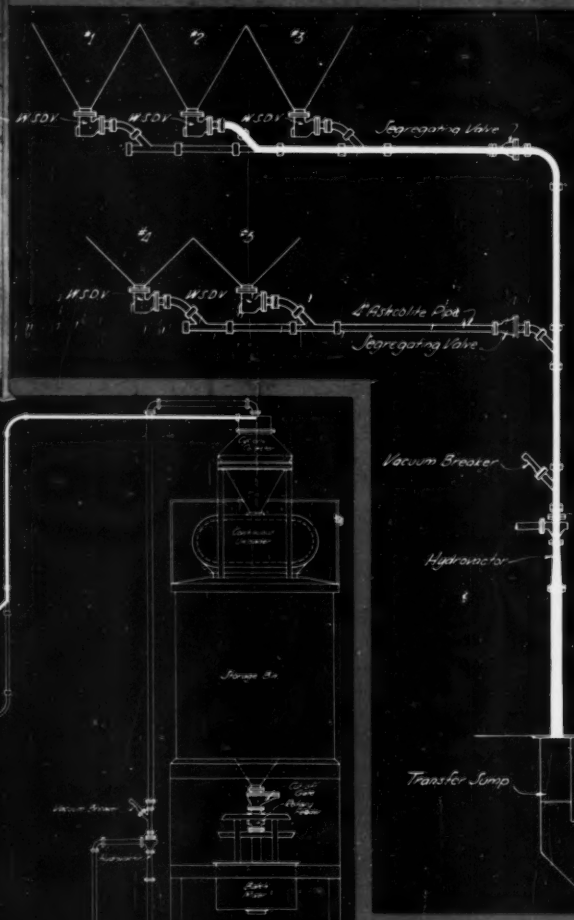


IN THIS ISSUE: Special report on coal and ash handling for small plants shows typical equipment layouts, costs and operating savings, p 91; "top" at Sherman Creek Station features largest boilers, unusual heat balance with steam-driven auxiliaries, p 112; modern air conditioning controls atmosphere in electronics plant (photo above), p 122. **CONTENTS, p 67**

Automatic Dust Handling Not a Luxury For Any Size Plant! It Pays Its Way

Push Button Dust Handling with the Automatic Sequence Hydrovac saves enough in operating time, attendance and maintenance to liquidate its additional cost over a hand operated Hydrovac System in a very short time. Liquid, wetted and dry dust disposal methods, developed by A-S-H, suit every plant condition. May our representative explain what "Automatic Sequence Hydrovac" can DO and SAVE for YOU?





Write for the NEW Hydrovac Catalog No. 448

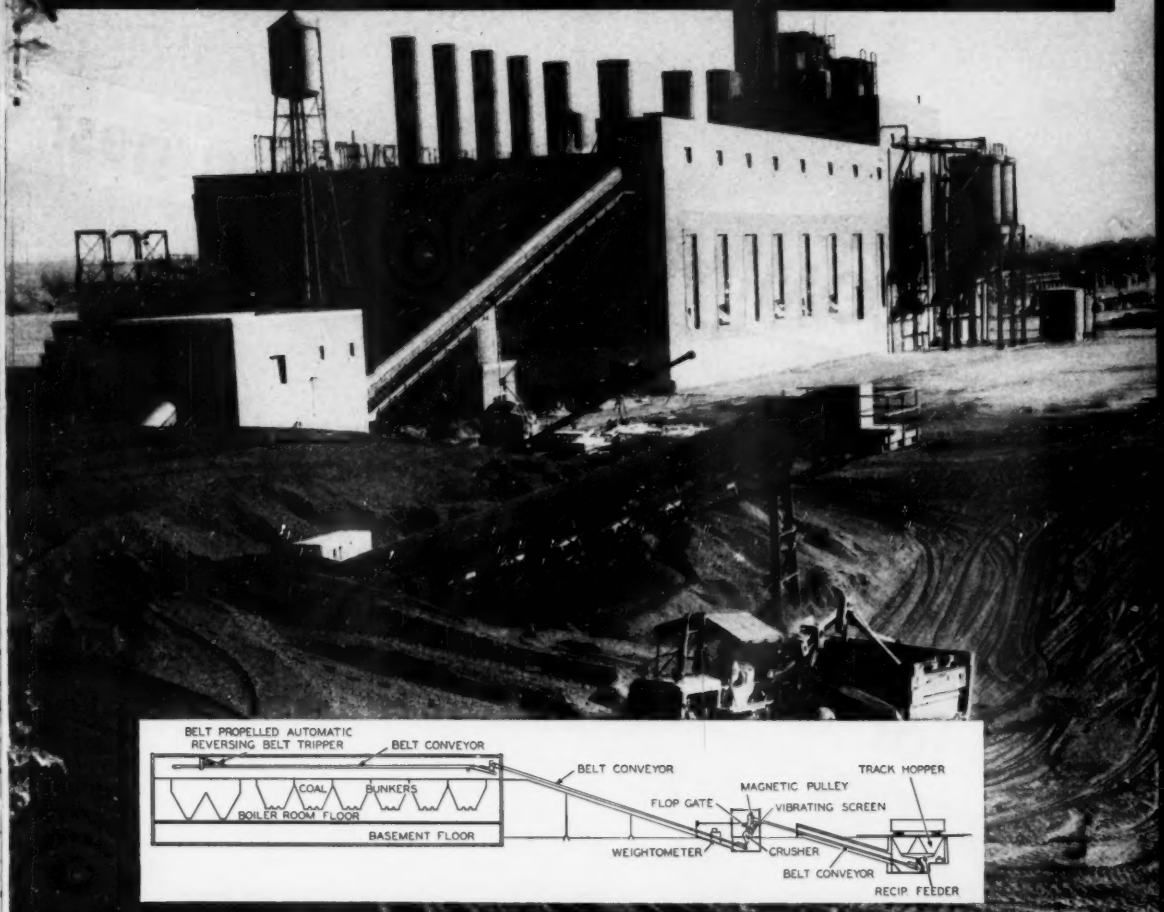
Above, dust and vacuum producing water discharging into sump, then pumped to distant locations by A-S-H Hydroseal Ash Pump.

Left, dust collected and stored dry, then periodically fed into A-S-H Automatic Batch Mixer which discharges wetted dust into cars or trucks.

ALLEN-SHERMAN-HOFF CO., 227 S. 15th ST., PHILADELPHIA 2, PA. Offices & Representatives in Principal Cities

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," "The Stationary Engineer"), February, 1949, Vol. 93, No. 2. Published monthly with an additional Directory number in June. McGraw-Hill Publishing Company, Inc. Editorial and executive offices, 330 W. 42nd St., New York 18, N. Y. Application pending for entry at New York, N. Y. as second-class matter, under the act of March 3, 1879. Printed in U.S.A. Allow at least 10 days for change of address. Subscription rates, U.S. and U.S. possessions, $5 for one year, $7 for two years, 50c per single copy. Canada, $6 for one year, $9 for two years. Pan American Countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years. Please indicate position and company connection on all subscription orders.

Tulsa Power Station Served by Link-Belt
Integrated Coal Handling System



High Efficiency, Capacity at Lowest Handling Cost

The diagram above shows how a Link-Belt integrated conveying system handles 150 tons of coal per hour at the new Tulsa, Oklahoma, power station (Sargent & Lundy, Chicago, consulting engineers).

Coal is dumped from railroad cars into hoppers equipped with double reciprocating feeders, which deliver it to an inclined belt conveyor. This belt passes over a magnetic pulley for removing tramp iron, and the coal then passes over a vibrating screen which separates the metal from whatever coal might be with it. The coal is crushed to 3¼" by 0" and delivered to the long belt conveyor which carries it to the bunkers above the boiler room. From the bunkers the coal is fed to pulverizers and blown into the boilers. The plant has an added capacity of 25,000 KW.

The list of generating plants with coal handling systems by Link-Belt is impressive. Why not apply Link-Belt "know-how" and products to your own problem?

TYPES OF LINK-BELT CONVEYING MACHINERY

Belt Conveyors	Bulk-Flo Conveyors
Bucket Carriers	Screw Conveyors
Bucket Elevators	Car Unloaders
Flight Conveyors	Coal Crushers
Chain Conveyors	Weigh Larries
Apron Conveyors	Skip Hoists

LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

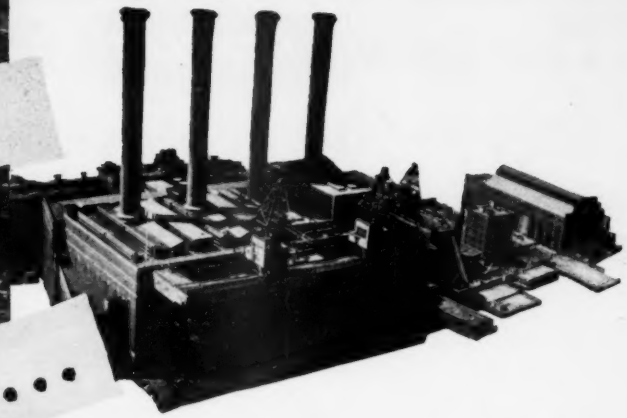
11,362

LINK-BELT

CONVEYING MACHINERY
"THE COMPLETE LINE"

COMING ... World's largest
for the world's largest steam-
.....in America's

boiler . . . . . electric plant . . . . largest city



Additional steam requirements at the world's largest steam-electric power plant—the Hudson Avenue Station of Consolidated Edison Company of New York, Inc. — will be supplied by the world's most powerful boiler — a B&W Radiant type unit now on order. It will have a continuous rating of 1,300,000 lb. of steam per hr. — 25 per cent more capacity than the next largest unit also on order at B&W for installation in the East River Station of the same utility. Steam will be generated in the new Hudson Avenue unit at 1675 psi and 1050F. It will be fired normally with pulverized coal from five B&W pulverizers through sixteen combination burners which can also be used for oil firing.

Perhaps the advanced engineering reflected in this outstanding unit can help you on present problems or future plans involving plant expansion.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.

GENERAL OFFICES: 85 LIBERTY STREET, NEW YORK 6, N. Y.
WORKS: ALLIANCE AND BARBERTON, O.; AUGUSTA, GA.

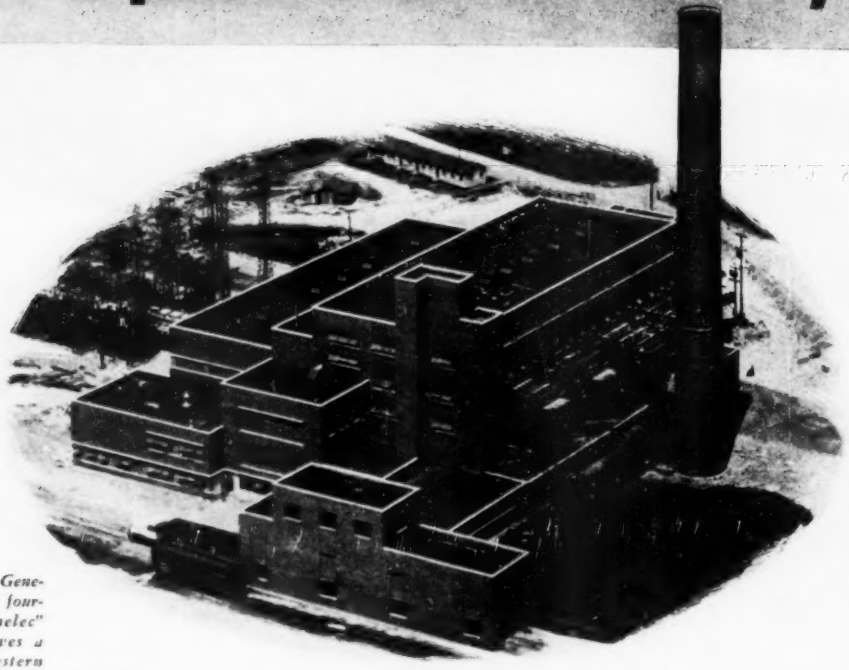
FOR POWER PLANTS—B&W, Open-Pass, Radiant, Integral-Furnace, Cross-Drum, Stirling and Waste-Heat Stationary Boilers . . . Air Heaters . . . Economizers . . . Superheaters . . . Water-Cooled Furnaces . . . Oil, Gas & Multifuel Burners . . . Chain-Grate Stokers . . . Stacks and Breechings . . . Seamless & Welded Tubes for All Pressure and Mechanical Applications . . . Refractories . . . Chemical Recovery Units . . . Alloy Castings.

★ ★ ★

OTHER B&W PRODUCTS — Marine Boilers . . . Pressure Vessels . . . Process Equipment.

G-412T

The new PENELEC Warren Station enjoys the protection and economy



The new Warren Generating Station is the fourteenth in the "Penelec" system, which serves a major part of western Pennsylvania.

THE FIRST of two 35,000-kw units for this fine new station of the Pennsylvania Electric Company went into operation last September. The second 35,000-kw unit will soon be on the line. Both units will be served by Elliott deaerating feedwater heaters and deaerating evaporator preheaters. Thus the steam handling equipment in the entire plant—boilers, valves, piping and all auxiliary equipment—is guarded against corrosion by supplying oxygen-free feedwater to the boilers. The deaerating units also serve as efficient heaters in the heat balance cycle, steam being supplied them from one of the four extraction stages of the turbine.

In addition to deaerating heaters, Elliott equipment in the Warren Station includes two 30,000-sq ft surface condensers, with auxiliaries, and various twin strainers.

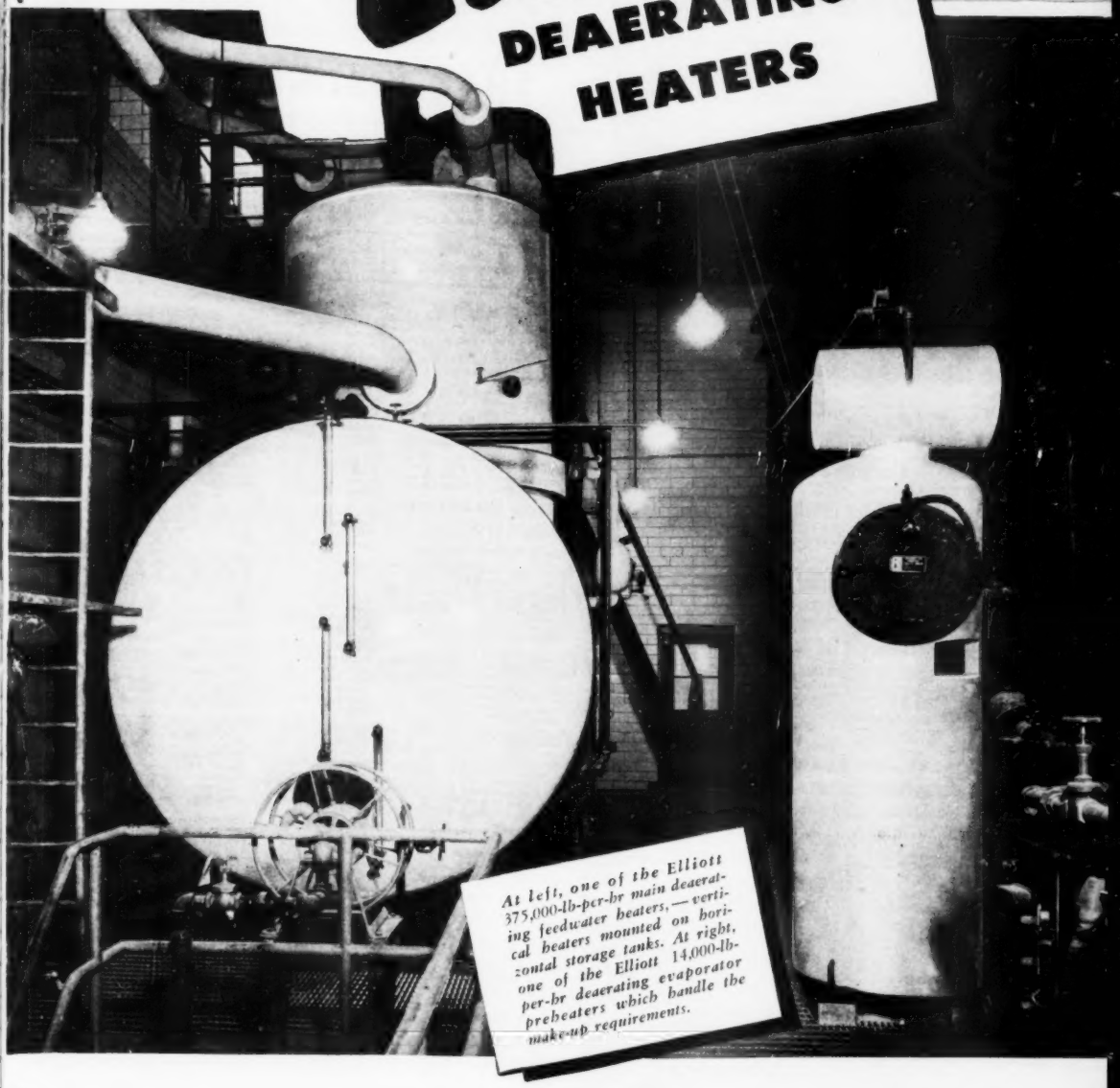
Reg. U.S. Pat. Off.

Elliott COMPANY

Deaerator & Heater Dept.,
JEANNETTE, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

of . . . Elliott DEAERATING HEATERS



At left, one of the Elliott 375,000-lb-per-hr main deaerating feedwater heaters,—vertical heaters mounted on horizontal storage tanks. At right, one of the Elliott 14,000-lb-per-hr deaerating evaporator preheaters which handle the make-up requirements.

N-995

STEAM TURBINES • GAS TURBINES • GENERATORS • MOTORS • CONDENSERS • FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS • CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES • TUBE CLEANERS • STRAINERS • EXPANDERS • FILTERS

85% of THESE INSTALLATIONS that have soot blowers

1948 Listing of Typical Central-Station

For Notes on Uses and Limitations of this Tabulation • See page 122

Compiled by B G A Skrotzki, Associate Editor

Company	Location	Plant Name
1200 PSI AND ABOVE		
Appalachian Elec Pwr Co	Graham Sta, W. Va	Philip Sporn
The Ohio Power Co	Graham Sta, W. Va	Philip Sporn
Indiana & Mich Elec Co	Mishawaka, Ind	Twin Branch
City of Detroit Pub Lig Comm	Detroit, Mich	Mistersky
Consolidated Edison Co of N Y	Manhattan, N. Y. C	Waterside No. 1
Consolidated Edison Co of N Y	Bronx, N. Y. C	Sherman Creek
Columbus & So. Ohio Elec Co	Nr. Athens, Ohio	Poston
Consolidated Edison Co of N Y	Manhattan, N. Y. C	East River
Iowa Power & Light Co	Des Moines, Iowa	Des Moines No. 3
1200 PSI TO 1499 PSI		
Boston Edison Co	Weymouth, Mass	Edgar
Buffalo Niagara Elec Corp	Dunkirk, N. Y	Dunkirk
Metropolitan Edison Co	Reading, Pa	Titus
New England Power Co	Salem, Mass	Salem Harbor
The Ohio Power Co	Brilliant, Ohio	Tidd
Florida Power & Light Co	Cutler, Fla	Cutler
City Public Service Board	San Antonio, Texas	Mission Road
Pacific Gas & Electric Co	Bakersfield, Calif	Kern
West Penn Power Co	Nr. Courtney, Pa	Mitchell
West Penn Power Co	Springdale, Pa	Springdale
Nebraska Public Power System	Bellevue, Nebr	Bellevue
Pacific Gas & Electric Co	San Francisco, Calif	Station P
Cambridge Electric Light Co	Cambridge, Mass	Kendall Sq
The Dayton Power & Light Co	Miamisburg, Ohio	O H Hutchings
The Detroit Edison Co	Trenton, Mich	Trenton Channel
Wisconsin Electric Power Co	Port Washington, Wis	Port Washington
Buffalo Niagara Elec Corp	Nr. Buffalo, N. Y	C R Huntley
Central New York Power Corp	Oswego, N. Y	Oswego
The Cincinnati Gas & Elec Co	Cincinnati, Ohio	West End
The Cincinnati Gas & Elec Co	Columbia Park, Ohio	Columbia
N.Y.C. Board of Transportation	Manhattan, N. Y. C	59th Street
Duke Power Co	Cliffside, N. C	Cliffside
Duke Power Co	Leaksville, N. C	Dan River
Connecticut Light & Power Co	Devon, Conn	Devon
Long Island Lighting Co	Port Jefferson, L. I	Port Jefferson
New Orleans Pub Service, Inc	New Orleans, La	Industrial Canal
Oklahoma Gas & Elec Co	Harrah, Oklahoma	Horseshoe Lake
Rochester Gas & Electric Corp	Nr. Charlotte, N. Y	Lakeside
Narragansett Electric Co	Providence, R. I	Manchester St
900 PSI TO 1199 PSI		
Arkansas Power & Light Co	Lake Catherine, Ark	Lake Catherine
Los Angeles Dept of Water & Pwr	Wilmington, Calif	Harbor
Gulf States Utilities Co	Lake Charles, La	Riverside
	Baton Rouge, La	Louisiana[34]
	Beaumont, Texas	Neches
Florida Power & Light Co	Miami, Florida	Miami
Louisiana Power & Light Co	Sterlington, La	Sterlington
Columbus & So. Ohio Elec Co	Nr. Columbus, Ohio	Picway
Duquesne Light Co	So. Heights, Pa	Phillips

A	—Air cooled	*CA*	—Coal, anthracite
AAlBr	—Arsenical aluminum-brass	*CB*	—Coke breeze
AAd	—Arsenical admiralty	*CE*	—Combustion Engineering Co
AlB	—Aluminum-bronze	*CuNi*	—Cupro-nickel
AlBr	—Aluminum-brass	*Cu*	—Copper
AC	—Allis-Chalmers Mfg Co	*DL*	—DeLaval Steam Turbine Co
Ad	—Admiralty	*D*	—Damper
Ads	—Admiralty, stabilized	*DB*	—Dry bottom
AnAd	—Antimony-admiralty	*EC*	—Erie City Iron Works
AsCu	—Arsenical copper	*El*	—Elliott Co
B&R	—Burns and Roe	*EM*	—Edge Moor Iron Works
BW	—Babcock & Wilcox Co	*FW*	—Foster Wheeler Corp
C	—Coal, bituminous	*G*	—Natural gas

1948 Listing of Typica

For Notes on Uses and Limitations of this Tabulation • See page 122

Compiled by B G A Skrotzki, Associate Editor

Company	Location	Plant Name	Consulting Engineers
Houston Lighting & Power Co	Houston, Texas	Greens Bayou	Ebasco Services
Jersey Central Power & Light Co	Sayreville, N. J	Raritan River	Burns & Roe
Kentucky Utilities Co	Tyrone, Ky	Tyrone	Sargent & Lundy
Georgia Power Co	Harryat, Ga	Atkinson	Commonwealth & South
Bd Water & Elec Light Comm	Lansing, Mich	Ottawa St	Burns & Roe
Public Svc Co of Colorado	Denver, Colorado	Lacombe	Electric Advisors
Public Service Co of N. H	Portsmouth, N. H	Resistance[17]	A A Winters
Georgia Power Co	Arkwright, Ga	Arkwright	Comm & Southern
600 PSI TO 899 PSI			
Rockland Light & Power Co	Tomkins Cove, N. Y	Hudson	Burns & Roe
Braddock Light & Power Co, Inc	Alexandria, Va	Station C	Stone & Webster
City of Burbank	Burbank, Calif	Burbank	C A Heinse
Virginia Electric & Power Co	Wheelwright, Va	Chesterfield	Stone & Webster
Virginia Electric & Power Co	Possum Point, Va	Possum Point	Stone & Webster
	Uncasville, Conn	Montville	United Engr & Const
Connecticut Light & Power Co	Devon, Conn	Devon	United Engr & Const
Alabama Power Co	Gadsden, Ala	Gadsden	Comm & Southern
Mississippi Power Co	Hattiesburg, Miss	Eaton	Comm & Southern
Public Serv Co of Indiana	Noblesville, Ind	Noblesville	Sargent & Lundy
Empire District Elec Co of Kan	Riverton, Kan	Riverton	Black & Veatch
Kentucky Utilities Co	Green River, Ky	Green River	Sargent & Lundy
Florida Power Corp	Enterprise, Fla	Geo E. Turner	J G White Engrg Corp
Florida Power Corp	Inglis, Fla	Inglis	J G White Engrg Corp
Central Illinois Light Co	East Peoria, Ill	R S Wallace	Comm & Southern
Central Illinois Pub Serv Co	Meredosia, Ill	Meredosia	Sargent & Lundy
Central Power and Light Co	Corpus Christi, Tex	Nueces Bay	Sargent & Lundy
Cons Gas, Elec Lt & Pwr Co, Balt	Baltimore, Md	Westport	
Dairyland Power Cooperative	Alma, Wis	Alma	Vern E Alden
Ohio Public Service Co	Shadyside, Ohio	R E Burger	Electric Advisors
N Y State Elec & Gas Corp	Dresden, N. Y	Greenidge	Gilbert Assoc
Arkansas-Missouri Power Co	Campbell, Mo	Jim Hill	Ebasco Services
Union Electric Power Co	Venice, Ill	Venice No. 2	Stone & Webster
Mississippi Power & Light Co	Nr Jackson, Miss	Rex Brown	Ebasco Services
New Bedford Gas & Edison Lt Co	New Bedford, Mass	Cannon Street	Gilbert Assoc
Kansas Gas & Electric Co	Wichita, Kan	Ripley	Ebasco Services
The Hartford Electric Light Co	Hartford, Conn	South Meadow	Stone & Webster
Illinois Power Company	Havana, Ill	Havana	Sargent & Lundy
Indianapolis Power & Light Co	Nr Martinsville, Ind	White River	Gibbs & Hill
Interstate Power Company	Lansing, Ia	Lansing	Sargent & Lundy
Iowa-Illinois Gas & Elec Co	Davenport, Iowa	Riverside	United Lt & Rwy Serv
Iowa Public Service Co	Waterloo, Iowa	Maynard	J F Pritchard
City of Jacksonville	Jacksonville, Fla	No. 2	Reynolds, Smith & H
City of Lakeland	Lakeland, Fla	Lakeland	Charles Larsen
Louisville Gas & Electric Co	Louisville, Ky	Paddy's Run	Pioneer Serv & Eng
Metropolitan Edison Co	Middletown, Pa	Crawford	Gilbert Associates
Northern Virginia Power Co	Riverton, Va	Riverton	Sanderson & Porter
Orlando Utilities Comm	Orlando, Fla	Orlando	Robert S Co
City of Pasadena	Pasadena, Calif	Pasadena	O H Hedrich
San Diego Gas & Electric Co	San Diego, Calif	Silver Gate	Pioneer Serv & Eng
Pennsylvania Electric Co	Warren, Pa	Warren	Gilbert Assoc
Southern California Edison Co	Redondo, Calif	Redondo	Stone & Webster
South Carolina Power Co	Charleston, S. C	Ingwood	Catuin & Southern
Southwestern Gas & Electric Co	Longview, Texas	Knox Lee	Sargent & Lundy
Southwestern Public Service Co	Borger, Texas	Riverview	
Staten Island Edison Corp	Travis, S. I., N. Y	Arthur Kill	George Fraas
Utah Power & Light Co	Carylurst, Utah	Orem	Ebasco Services
Wisconsin Power & Light Co	Beloit, Wis	Blackhawk	Sargent & Lundy
Minnesota Power & Light Co	Duluth, Minn	Duluth	Ebasco Services
Dallas Power & Light Co	Dallas, Texas	Mt. Creek	Ebasco Services
Dallas Power & Light Co	Dallas, Texas	Dallas	Ebasco Services
Worcester County Electric Co	Worcester, Mass	Webster Street	United Eng & Con
Southern Indiana Gas & Elect Co	Evansville, Ind	Ohio River	Comm & Southern
600 PSI TO 799 PSI			
Central Illinois Elect & Gas Co	Rockford, Ill	Fordam	Stone & Webster
Sioux City Gas & Electric Co	Sioux City, Iowa	Kirk	J F Pritchard

A	—Air cooled	*CA*	—Coal, anthracite
AAlBr	—Arsenical aluminum-brass	*CB*	—Coke breeze
AAd	—Arsenical admiralty	*CE*	—Combustion Engineering Co

DIAMOND POWER SPECIALTY CORP.

HAVE **DIAMOND SOOT BLOWERS**

and Municipal Power-Plant Installations

entral-Station and Mu

1948 Listing of Typi

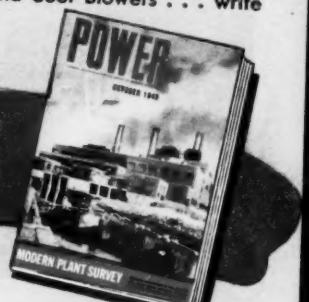
Year after year after year, this OVERWHELMING PREFERENCE continues

A comparison of Power's 1948 Modern Plant Survey (Central Stations and Municipal Power Plants) with our order records reveals that 85% of the installations listed that use soot blowers have selected Diamond Soot Blowers. In the nine previous surveys published by Power since June 1934, the average for Diamond Soot Blowers was 83.5%.

This record is certainly conclusive evidence of continuing complete superiority . . . superiority of product, of application engineering, and of service.

Included in the 85% are all types of Diamond Soot Blower installations . . . from manually operated individual blowers to completely automatic sequential systems. New Catalog No. 1014 describes and illustrates the many features of the various Diamond Soot Blowers . . . write for a copy.

LIST PUBLISHED IN POWER, October, 1948



Detroit 31, Mich. · DIAMOND SPECIALTY LIMITED, WINDSOR, ONTARIO

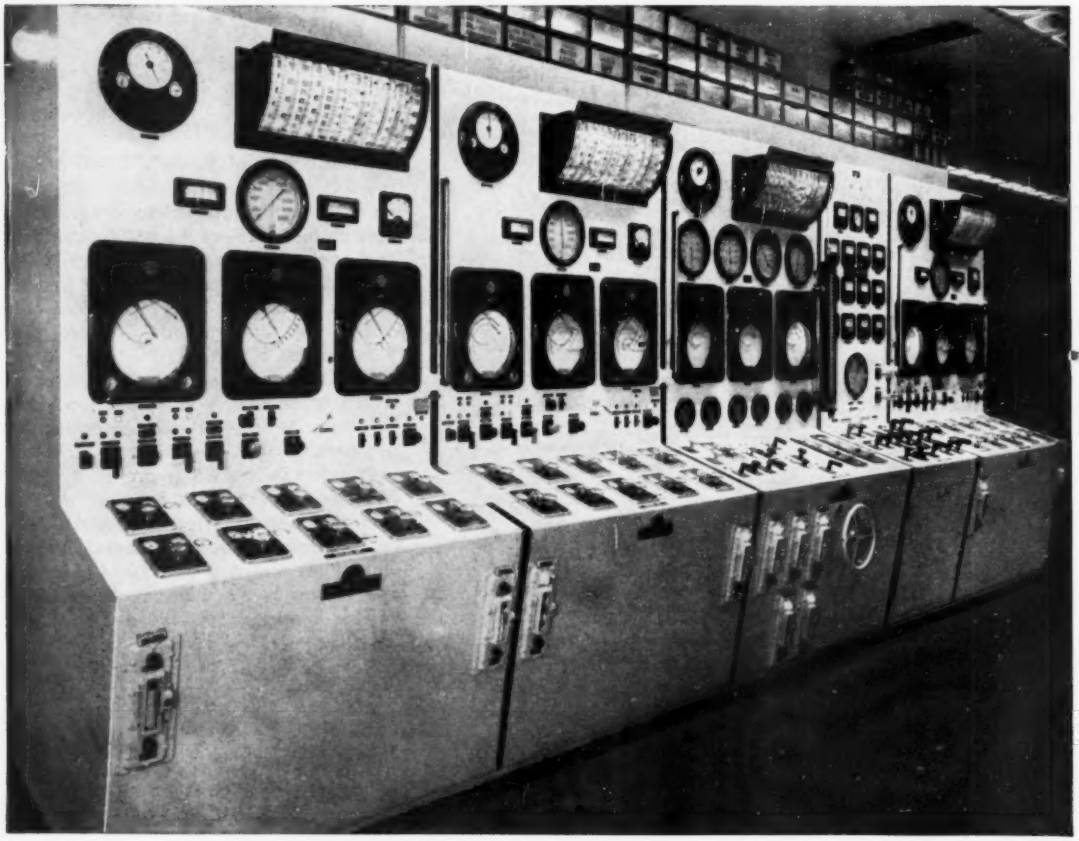
For Notes on Uses and Limitations of this Tabulation • See page 122

Compiled by B G A Skrotzki, Associate Editor

Company	Location	Plant Name	Consulting Engineers
Consolidated Edison Co of N Y	Bronx, N. Y.	Hunts Point	
Gulf States Utilities Co	Baton Rouge, La.	Louisiana	Stone & Webster
New York State Elec & Gas Corp.	Bainbridge, N. Y.	Jennison	Gilbert Assoc
Oklahoma Gas & Electric Co	Ponca City, Okla.	Beerbower	Pioneer Serv & Eng Co.
Eastern Shore Pub Serv of Md.	Vienna, Md.	Vienna	United Eng & Const.
Kansas Gas & Electric Co.	Wichita, Kan.	Ripley	Ebasco Services
Missouri Utilities Company	Oran, Mo.	Harry Newman	J F Pritchard
Northwestern Public Service Co.	Mitchell, S. D.	Mitchell	Sargent & Lundy
Public Service Co of Oklahoma	Weleetka, Okla.	Weleetka	Sargent & Lundy
Southwestern Public Serv Co.	Abernathy, Texas	Tuco	
Southwestern Public Serv Co.	Amarillo, Texas	East	
Southwestern Public Serv Co.	Carlsbad, N. M.	Carlsbad	
Texas Electric Service Co	Monahans, Texas	Permian Basin	Ebasco Services
Texas Electric Service Co	Wichita Falls, Texas	Wichita Falls	Ebasco Services
Kansas City Power & Light Co.	Kansas City, Mo.	Grand Avenue	United Lt & Rwy Serv.
Iowa Public Service Co.	Eagle Grove, Iowa		J F Pritchard
Iowa Public Service Co.	Storm Lake, Iowa	Hawkeye	J F Pritchard
Central Louisiana Electric Co.	St Landry, La.	Coughlin	Sargent & Lundy
Glendale Public Service Dept.	Glendale, Calif	Glendale	Carl Heinze
Public Service Co of New Mexico	Albuquerque, N. M.	Albuquerque	Stearns, Roger
City of Lubbock	Lubbock, Texas	Lubbock	Truman Green
Missouri Power & Light Co.	Mexico, Mo.	Mexico	Black & Veatch
West Texas Utilities Co.	Abilene, Texas	Abilene	Sargent & Lundy
Menasha Elec & Water Util.	Menasha, Wis.		Laramore & Douglass
600 PSI AND BELOW			
El Paso Electric Co.	El Paso, Texas	Rio Grande	Stone & Webster
Provo City	Provo, Utah	Provo City	Burns & McDonnell
City of Crawfordsville	Crawfordsville, Ind.	Crawfordsville	Comm Testing & Eng.
Montana-Dakota Utilities Co.	Acme, Wyo.	Acme	
Public Utilities Commission	New Ulm, Minn.		J T Rynda, Jr.
Village of Winnetka	Winnetka, Ill.	Winnetka	Sargent & Lundy
Florida Power & Light Co.	Lake Monroe, Fla.	Sanford	Ebasco Services
Dept of Utilities	Fremont, Nebr.		Luts & May
Southwestern Public Service Co.	Denver City, Texas	Denver City	
City of Rocky Mount	Rocky Mount, N. C.		W C Olsen
Board of Public Works	Poplar Bluff, Mo.		Rogers Schmidt
Southwestern Electric Service Co.	Jacksonville, Texas	Jacksonville	D C Pfeiffer
Water & Electric Dept.	McPherson, Kan.	McPherson	
City of Fairbury	Fairbury, Nebr.		Black & Veatch
Greenwood Elec Lt & Water	Greenwood, Miss.		
Town of Wilson	Wilson, N. C.		W C Olsen
City of Thomasville	Thomasville, Ga.	Thomasville	
City of Hagerstown	Hagerstown, Md.		A C Wood & Assoc.
City of Hastings	Hastings, Nebr.		Black & Veatch
Greenwood County Elec Pwr Comm.	Chappells, S. C.	Buzzards Roost	G Hill
Manitowoc Public Utilities	Manitowoc, Wis.		
Water & Light Dept	Virginia, Minn.		Laramore & Douglass
Borough of Vineland	Vineland, N. J.		H A Kuljian
Public Service Dept.	Moorehead, Minn.		Helmick, Edeskuty
City of Kansas City	Kansas City, Kan.	Quindaro	Burns & McDonnell
Municipal Light & Water	Clay Center, Kan.		A C Kirkwood
City of Willmar	Willmar, Minn.	Willmar	Pfeifer & Shults
Municipal Utilities	Sleepy Eye, Minn.		Pfeifer & Shults
Mt. Carmel Public Utility	Mt. Carmel, Ill.	Mt. Carmel	
City of Gainesville	Gainesville, Fla.		Robert & Co.
City of Carlyle	Carlyle, Ill.		
Austin, Minn.	Austin, Minn.		Edeskuty
Atlantic, Iowa	Atlantic, Iowa		Stanley Eng Co.
Board of Public Works	Alexandria, Minn.		Pfeifer & Shults
City Light & Water Utilities	Kalamazoo, Mich.		Hubbard Eng Co.
Missouri Public Service Corp.	Clinton, Mo.	Clinton	Burns & McDonnell
Missouri Public Service Corp.	Sedalia, Mo.	Sedalia	Burns & McDonnell
Otter Tail Power Co.	Devils Lake, N. D.	Devils Lake	
The Western Colorado Power Co.	Durango, Colo.	Durango	
City of Frankfort	Frankfort, Ind.		Emery, Marker &
City Water & Light	Jonesboro, Ark.		N B Thayer
Sioux City Gas & Elec Co.	Sioux City, Iowa	Big Sioux	J F Pritchard
Consolidated Edison Co of N. Y.	Long Island City, N. Y.	Ravenswood	J G White Eng Co.
Consolidated Edison Co of N. Y.	Manhattan, N. Y. C.	65th Street	Baker & Spencer
Southwestern Gas & Elec Co.	Karnack, Texas	Karnack	Sargent & Lundy
Pacific Power & Light Co.	Portland, Ore.	Pittock	Ebasco Services
City of Escanaba	Escanaba, Mich.	Steam Heating	Laramore & Douglass
Westchester Lighting Co.	Pelham Manor, N. Y.	Pelham	

Air cooled — CA —Coal, anthracite

put your Btu's



Bailey Boiler Panel for a co-ordinated system of Combustion, Feed Water and Steam Temperature Control on three 1500 psi, 950 F, 200,000 lb. per hour gas and oil-fired boilers.

Branches in: Boston, New York, Schenectady, Philadelphia, Buffalo, Pittsburgh, Cleveland, Detroit, Cincinnati, Atlanta;

in shirtsleeves

You can't have low power costs unless the Btu's you feed your boiler roll up their sleeves and go to work. They all won't anyway. The job to do is to put as many to work as possible. Then you get low power costs. And that is exactly what the Bailey co-ordinated boiler control system is designed to do.

This system reduces fuel consumption per pound of steam generated. Combustion, feed water, steam temperature, heater levels, pump speeds and all other factors are co-ordinated. Safety of operation is increased—continuity of service is improved.

You put the maximum number of Btu's to work in power and get all the efficiency your boiler was designed to deliver.

But remember this. The Bailey system is not delivered as a standard package. Each one is designed and engineered to the specific job on which it is to be used. That's why it functions so efficiently.

If you are looking for low cost power, it will pay you to call our nearest office.

BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND 10, OHIO
BAILEY METER COMPANY LIMITED, MONTREAL

Controls for Steam Plants

COMBUSTION • FEED WATER • TEMPERATURE
PRESSURE • LIQUID LEVEL • FEED PUMPS

A-103-2

Chicago, Milwaukee, St. Louis, New Orleans, St. Paul, Kansas City, Houston, Denver, Los Angeles, Seattle, San Francisco

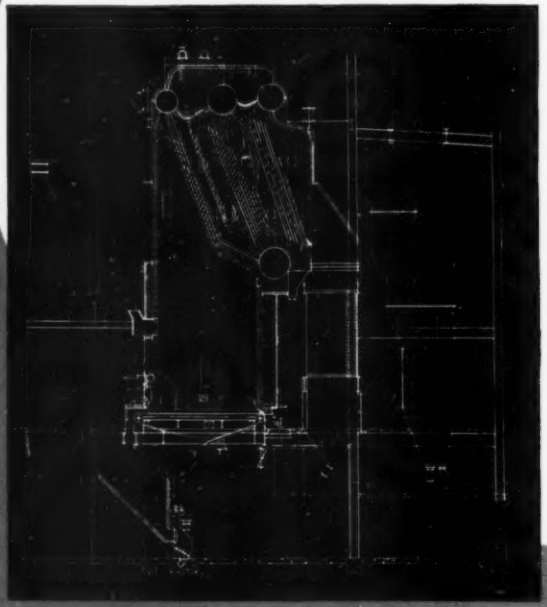
J&L STEEL Chooses

DETROIT ROTOGRATE STOKERS

FOR NEW MILLION POUND STEAM PLANT

Jones & Laughlin Steel Corporation, Pittsburgh, selected Detroit RotoGrate Stokers for their new steam plant.

The five units for this plant will have a total maximum capacity of 1,000,000 pounds of steam per hour. They replace 43 smaller boilers now in service in four separate locations at their "Pittsburgh Works".



RotoGrates applied to four drum units designed for 300 degrees F. preheat.

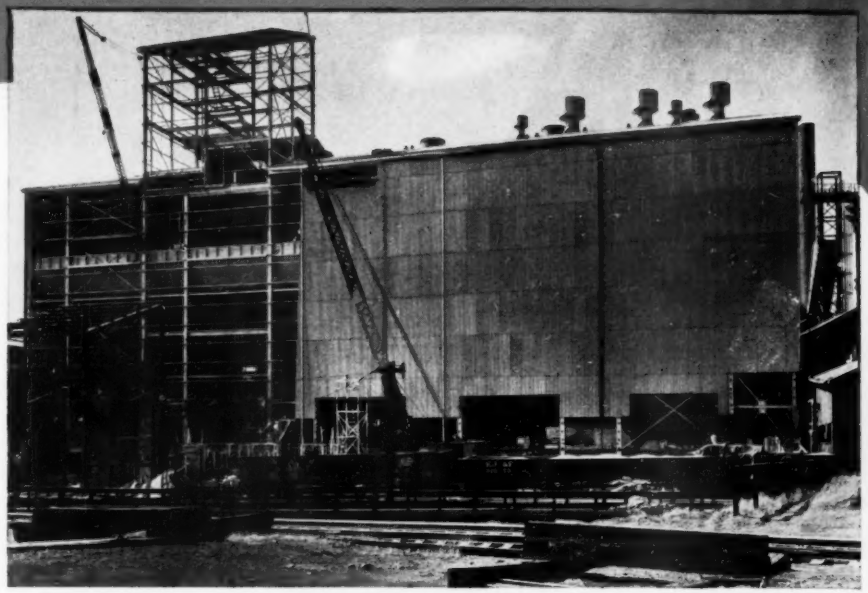
The RotoGrate Stoker has met the most exacting requirements in all types of plants. A spreader stoker with forward moving grates that discharge the ash at the front. Burns any Bituminous Coal or Lignite with high efficiency.

Write for the RotoGrate

BULLETIN

No obligation

OTHER TYPES AND SIZES OF DETROIT STOKERS FOR EVERY INDUSTRIAL OR POWER NEED.



Construction view of new 4½ million dollar J. & L. Boiler Plant on the South Side of Pittsburgh.

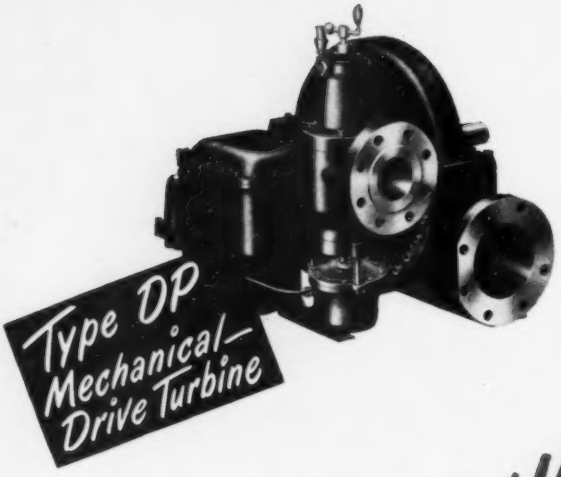
Professor Sumner B. Ely, Superintendent of the Pittsburgh Smoke Prevention Bureau, lights the first RotoGrate in the presence of J. & L. officials.

DETROIT SINCE 1898 STOKERS

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

WORKS AT MONROE, MICHIGAN • DISTRICT OFFICES IN PRINCIPAL CITIES



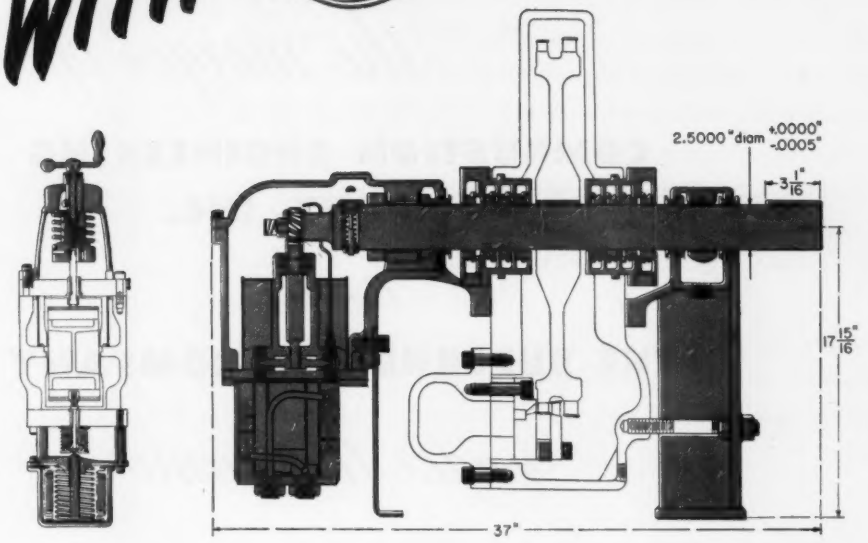
HERE'S HOW YOU SAVE

SAVE ON SPARE PARTS because of high degree of interchangeability of the new Type DP line. (Cross-section drawing shows parts interchangeable on all frame sizes.)

You can reduce your spare parts inventory with this standard kit, containing parts applicable to *all* standard Type DP turbines. With this set of packaged spares *you save 75%* of price of comparable set of loose spares for previous designs.

With the DP you save money on first cost too. Only G.E. offers hydraulic governing (30% adjustable speed range) on a standard turbine — at no extra cost.

WITH GE TURBINES



PARTS IN COLOR INTERCHANGEABLE ON ALL FRAME SIZES

SAVE TIME when installing DP turbines or when re-locating them in your plant. (Drawing shows dimensions common to all frame sizes.) Standard shaft height permits you to use a fixed mounting height on all your turbine drives. Standardization of the DP saves time on deliveries too—shipment time is approximately 20 weeks.

When it comes to alignment, you'll appreciate the DP's center-line support — now standardized on all frame sizes. Center-line support eliminates mis-alignment resulting from expansion from normal heating.

SAVE TROUBLE because of superior design features of the new Type DP — features such as: totally enclosed governing system protected in an oil atmosphere against rusting and sticking (particularly a problem on standby units); nonsparking overspeed trip, suitable for explosive atmospheres; new long-life solid-backed bearings; Monel-sprayed shaft at packings to eliminate corrosion; positive pressure lubrication; balanced valve design, and many other improvements to reduce maintenance.

The new Type DP is not a "standard turbine" for a narrow range of ratings only, but a standardized *line*, in ratings from 10 to approximately 1200 hp, speeds from 1000 to 5000 rpm. Thus, if your turbine drives fall within this wide range, you can save money — time — and trouble — by standardizing on the Type DP. For full information get in touch with your G-E representative. ***Apparatus Department, General Electric Company, Schenectady 5, N. Y.***

GENERAL ELECTRIC

252-31

Announcing the merger of

COMBUSTION ENGINEERING COMPANY, INC.

and

THE SUPERHEATER COMPANY

under the name

PROPERTIES

Affiliated Companies

Combustion Engineering Corporation, Ltd., Montreal
Combustion Engineering de Mexico, S. A., Mexico, D. F.
Combustion Engineering Ltda., Rio de Janeiro
Combustion Publishing Company, Inc., New York
The Superheater Company, Ltd., Montreal
The Superheater Company, Ltd., London
The Superheater Company, Pty., Ltd., Sydney
Compagnie des Surchauffeurs, Paris
Stein et Roubaix, Paris
N. V. Carbo-Union Industrie Maatschappij, Rotterdam
Kohlenscheidungs-Gesellschaft, m.b.H., Stuttgart

Manufacturing Plants

U. S. A. — Chattanooga, Chicago, East Chicago, Monogahela, St. Louis
Canada — Sherbrooke, Quebec
Abroad — Manchester, Eng.; Paris and Roubaix, France

Offices and Representatives

Principal cities of the U. S. A., Canada and Latin America.
Also London, Paris, Rotterdam, Hawaii and Shanghai

PRODUCTS

For stationary and marine power plants

Complete steam generating units comprised of all types of boilers, fuel burning and related equipment for capacities from 1000 to 1,000,000 lbs. of steam per hr.

For railroads

Superheaters, steam driers, feedwater heaters, exhaust steam injectors and heater valves for steam locomotives. Steam generators for train heating

For pulp mills

Units for recovery of chemicals and waste heat

For process industries

Mills, pulverizers, air separators and flash drying systems for grinding, drying and separation. Pressure vessels, columns, towers, tanks

For synthetic oil plants

Steam generators, separately-fired superheaters, gas generators, catalyst reactors

For municipalities

Flash drying and incineration systems for sewage sludge

For homes

Automatic gas and electric water heaters. Soil pipe.

The close association of Combustion Engineering Company, Inc. and The Superheater Company since their affiliation in 1933 has provided the opportunity for long and careful study of the advantages that might be obtained by complete merger under a single management. The fact that a major part of the activity of both companies involved the manufacture of different but related components of steam generating units prompted the taking of some steps in the direction of merger shortly after affiliation. The resulting experience led to a continuing program designed to bring about ever closer coordination of staff and operations. Thus the complete merger, which became effective on January 1, 1949, was but the final step in the unification of two organizations long experienced in working together to achieve common objectives.

The new company will continue all past activities of Combustion and Superheater, as summarized at the left, and will be able to offer the combined facilities and services of both organizations on a world-wide scale.

B-283A

COMBUSTION

ENGINEERING—

SUPERHEATER, INC.

C·E ELESCO

Combustion Engineering – Superheater, Inc.

200 Madison Avenue, New York 16, N. Y.

RAILROAD EQUIPMENT DIVISION—60 E. 42nd St., New York 17, N. Y.

A *New* YARWAY AID TO . . .

BETTER POWER

HI-LO-GRAPH LIQUID LEVEL RECORDER

Permanent, hour-by-hour records of boiler water levels can be charted with the new Yarway Hi-Lo-Graph.

The Hi-Lo-Graph not only *records* . . . it also *indicates* boiler water level changes. Brightly lighted active section of the chart makes pen arm clearly visible as indicator.

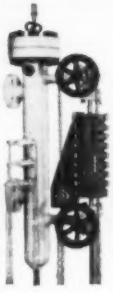
Indication is *instant* and *accurate* because the Hi-Lo-Graph is operated by the boiler water itself. No stuffing boxes. Actuating mechanism is never under pressure.

Easily installed on new or existing boilers. Designed for wall or panel mountings. For all pressures up to 2500 psi.

For complete description, write for new Yarway Bulletin WG-1830.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

OTHER YARWAY LIQUID LEVEL INDICATING EQUIPMENT



WATER COLUMNS AND GAGES

Yarway columns feature the *floatless* Hi-Lo-Alarm Signal. Two types of gages—Sasure Inclined and Vertical Flat Glass. Write for Catalog WG-1811.

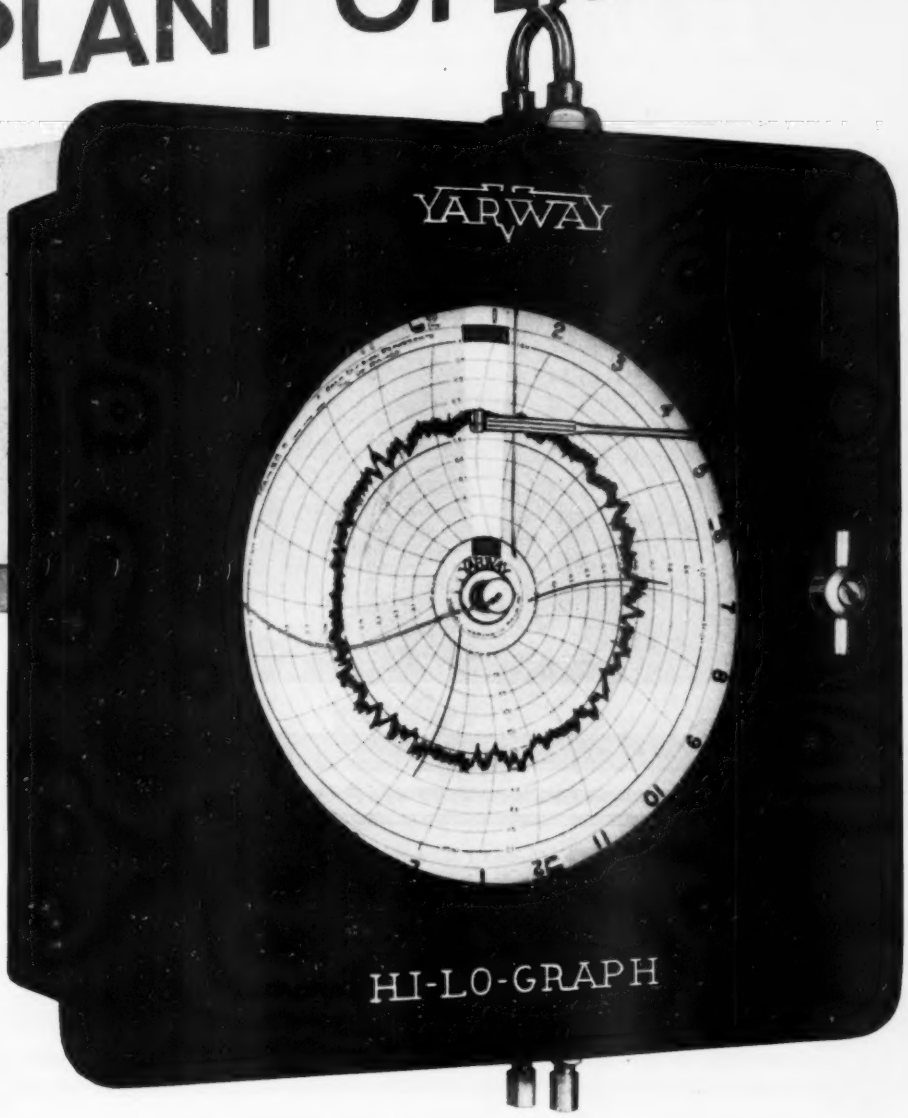
REMOTE LIQUID LEVEL INDICATOR

Brings overhead gage readings right down to eye level—on instrument panel or other convenient place. *Instant, accurate* indication. Completely described in Catalog WG-1822.

REMOTE HORN AND LIGHT SIGNAL ALARMS

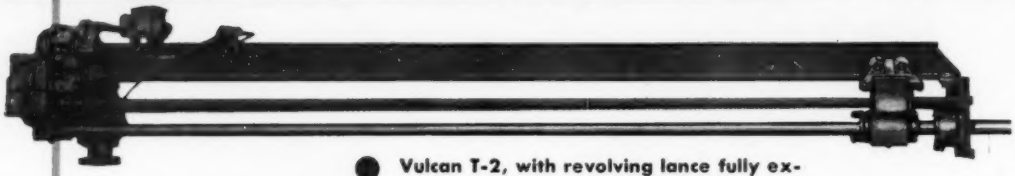
Operated anywhere in power plant by Control Unit located on YarwayRemote Liquid Level Indicator. Completely described in Catalog WG-1822.

PLANT OPERATION



YARWAY **POWER PLANT EQUIPMENT**

HERE'S WHY



● **Vulcan T-2, with revolving lance fully extended, cuts different cleaning patterns on forward and retracting cycles.**

● **Vulcan T-2 with lance retracted and protected from high furnace temperatures, while not in action.**

more than 500 VULCAN

T-2 Long Retractable Soot Blowers ARE IN SERVICE or on ORDER

Fully Automatic . . . Simple push button control . . . All parts easily accessible . . . Gears sealed in oil . . . Ball or roller bearing throughout . . . Non-corrosive stationary feed tube . . . Flanged lance . . . Alloy nozzle head with dynamically balanced jets . . . Dual motor drive . . . Uses either steam or air as cleaning medium . . . Can be installed at any angle or inverted . . . Shipped complete ready for steam or air connection.

VULCAN, T-2 In a class by Itself

Wherever high furnace temperatures, hard-to-reach locations or difficult cleaning conditions exist, look to Vulcan T-2, the long retractable blower. With over 500 in service or on order, T-2's are in a class by themselves.

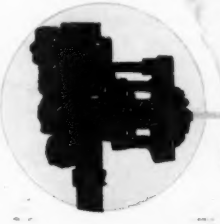
Install T-2's at any angle, inverted or upright, outdoors or indoors, or in the dirtiest locations. The sealed traversing and control mechanism assures trouble free operation. The dual motor drive not only permits double cleaning action, but keeps maintenance down by decreasing lance warpage and increasing packing life

• • •

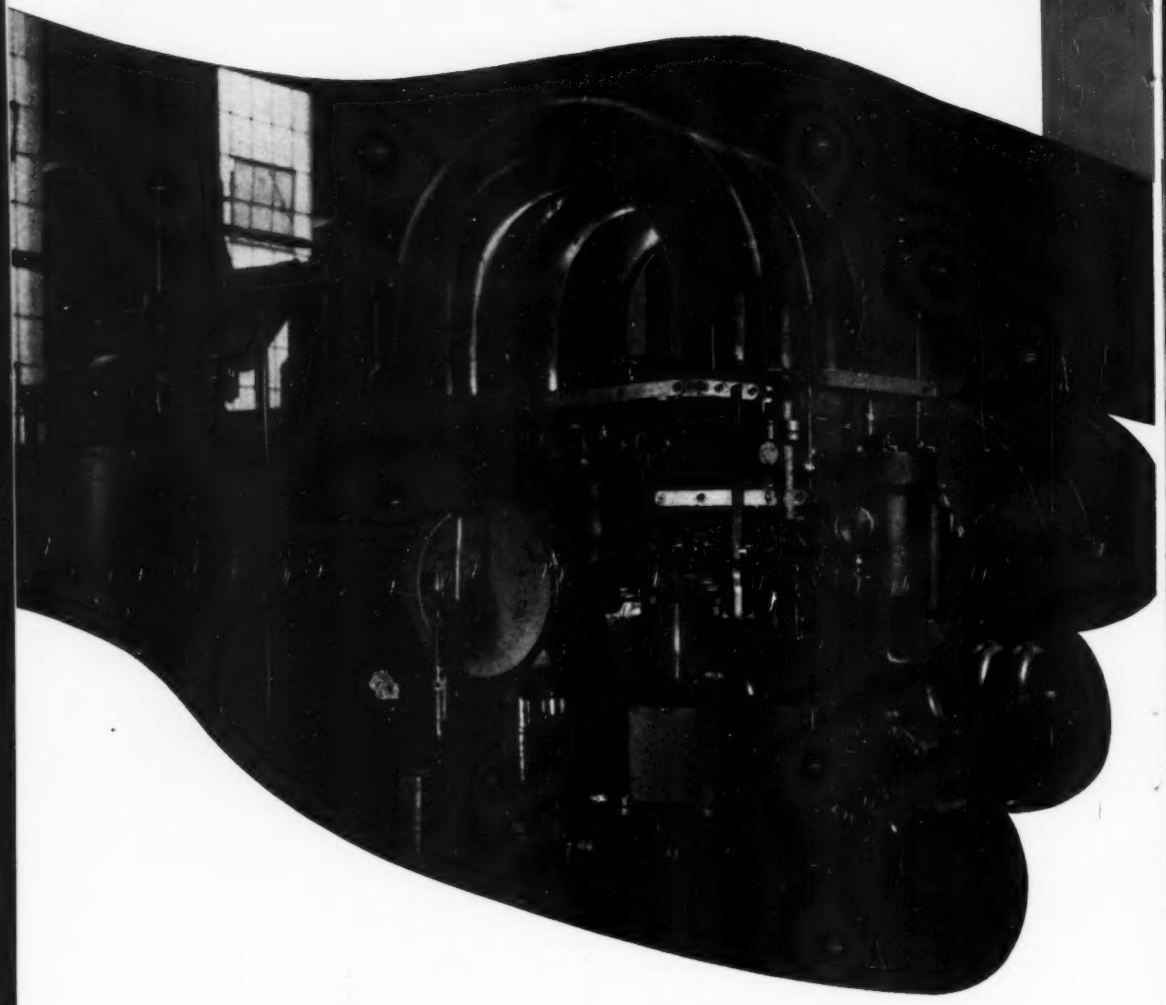
T-2's are shipped complete . requiring only steam or air connections. They operate at the touch of a button. Vulcan T-2's ask for your tough cleaning jobs. Outline your problem. Write for Bulletin No. 474 today.

VULCAN SOOT BLOWER CORPORATION • DUBOIS, PENNSYLVANIA

VULCAN
STEAM OR AIR



SOOT BLOWERS



***GUARANTEE**

"We guarantee that Nonpareil Turbine Oil, Medium and Heavy, will last as long as your turbine where the lubrication system is thoroughly cleaned before this oil is put into use and where Nonpareil Turbine Oil, Medium or Heavy only, is used for replenishment, and where the temperature of the oil from the bearings is kept below 170° F. This guarantee has no time limit. If at any time, when the oil is operating under the above conditions, the neutralization number should rise higher than the extremely low limit of 0.15 when determined by A.S.T.M. Method D 188-27 T, we will cheerfully replace the oil without additional expense."

STANDARD

STANDARD OIL COMPANY (INDIANA)

5 safeguards against outages

NONPAREIL TURBINE OIL

Under varying service conditions, one or all of these turbine oil qualities can bring added dependability to your turbine operation.

1. ***Nonpareil does not form asphaltic deposits.*** Delicate governor parts, oil lines, and bearings stay clean because the refining process removes from the oil all asphaltene-forming hydrocarbons.

2. ***Nonpareil does not increase in acidity*** above 0.15 mg.KOH/gm no matter how long it is left in a turbine. This is *guaranteed** in writing.

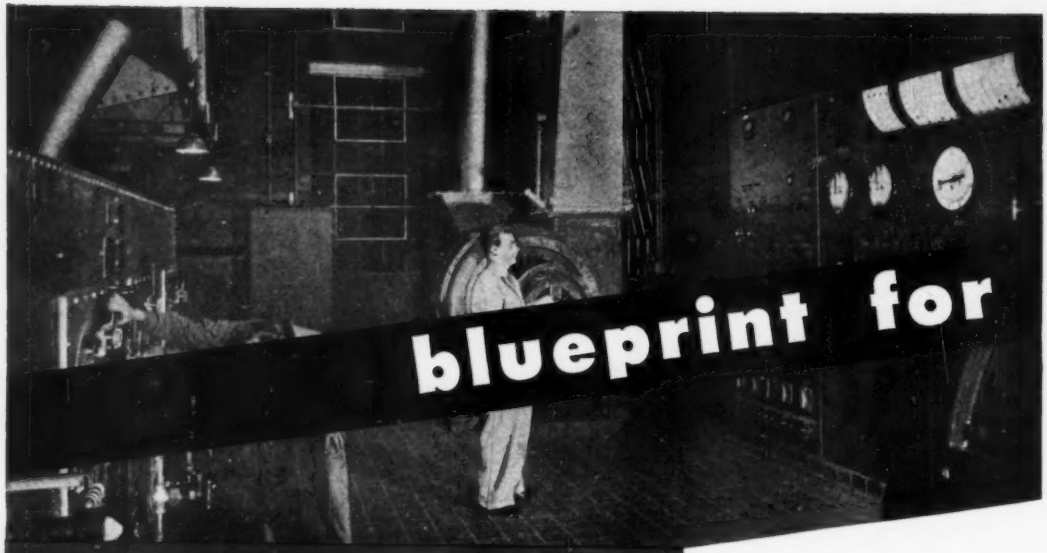
3. ***Nonpareil does not need treating, resting or replacing.*** There are no interruptions to turbine operation because of oil deterioration.

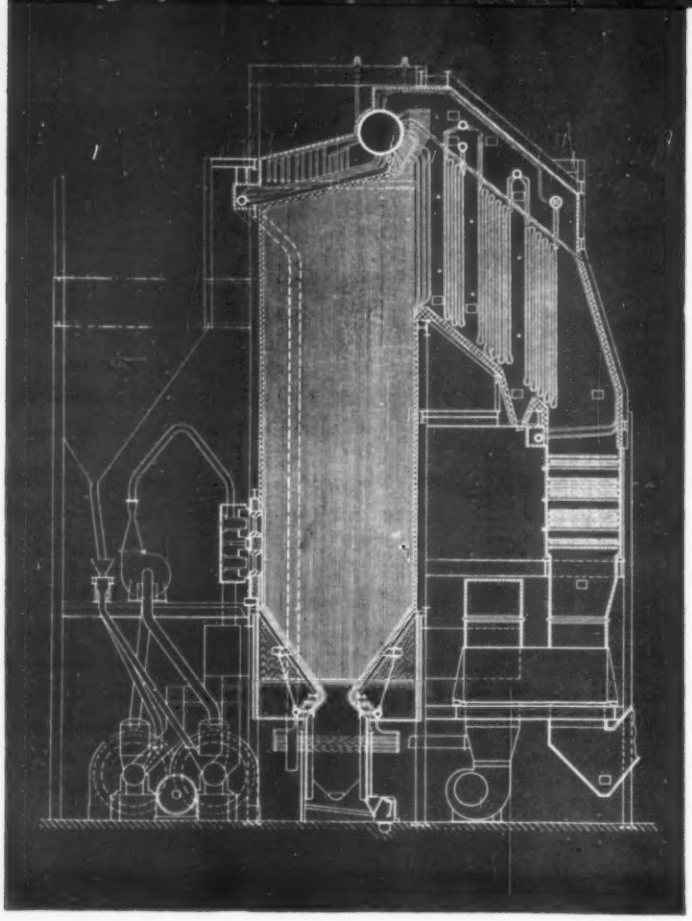
4. ***Nonpareil resists foaming.*** It contains an anti-foam additive which prevents oil overflow, eliminating a potential fire hazard or loss of oil.

5. ***Nonpareil contains a corrosion inhibitor*** and passes A.S.T.M. D-665-46T test for corrosion resistance.

20 years of operation prove that Nonpareil-lubricated turbines require no outage time for oil system maintenance. You can check this fact with nearby users of Nonpareil. A Standard Oil Lubrication Engineer will give you their names and locations. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois for the nearest Engineer.

STANDARD OIL COMPANY (INDIANA) STANDARD





E. M. POSTON STATION
COLUMBUS AND SOUTHERN OHIO ELECTRIC COMPANY

Steam Capacity
425,000 lb per hr

Superheat control range
300,000 to 425,000 lb per hr

Pressure superheater outlet
1354 psi

Final steam temperature
955 F

Bituminous Coal Pulverized
in FW Ball Mills

standardization

Standardized Steam Generating Equipment for Central Stations

Foster Wheeler has demonstrated outstanding leadership in developing central station equipment which helped the Utility Industry to achieve increased productivity. A large share of the credit can be directly ascribed to the FW line of single-pass, baffle-less steam generators having liberal furnace dimensions. This arrangement has been used as the basis for "Preferred Standard" steam generator designs which have been developed by Foster Wheeler Corporation for the Utility Industry.

Engineering and Manufacturing Costs Reduced

The "Preferred Standard" steam generator design (suggested on the right) promises substantial savings by the reduction of engineering and fabrication costs.

Fixed Individual Equipment Details

The unit being built for the E. M. Poston Station of the Columbus and Southern Ohio Electric Company is typical of the single-pass design which Foster Wheeler is using as the basis for "Preferred Standard" steam generators. This standardized steam generator pattern with fixed individual equipment details may be readily applied to a series of single or twin furnace units varying in capacity from 300,000 lb per hr to over 1,000,000 lb per hr.

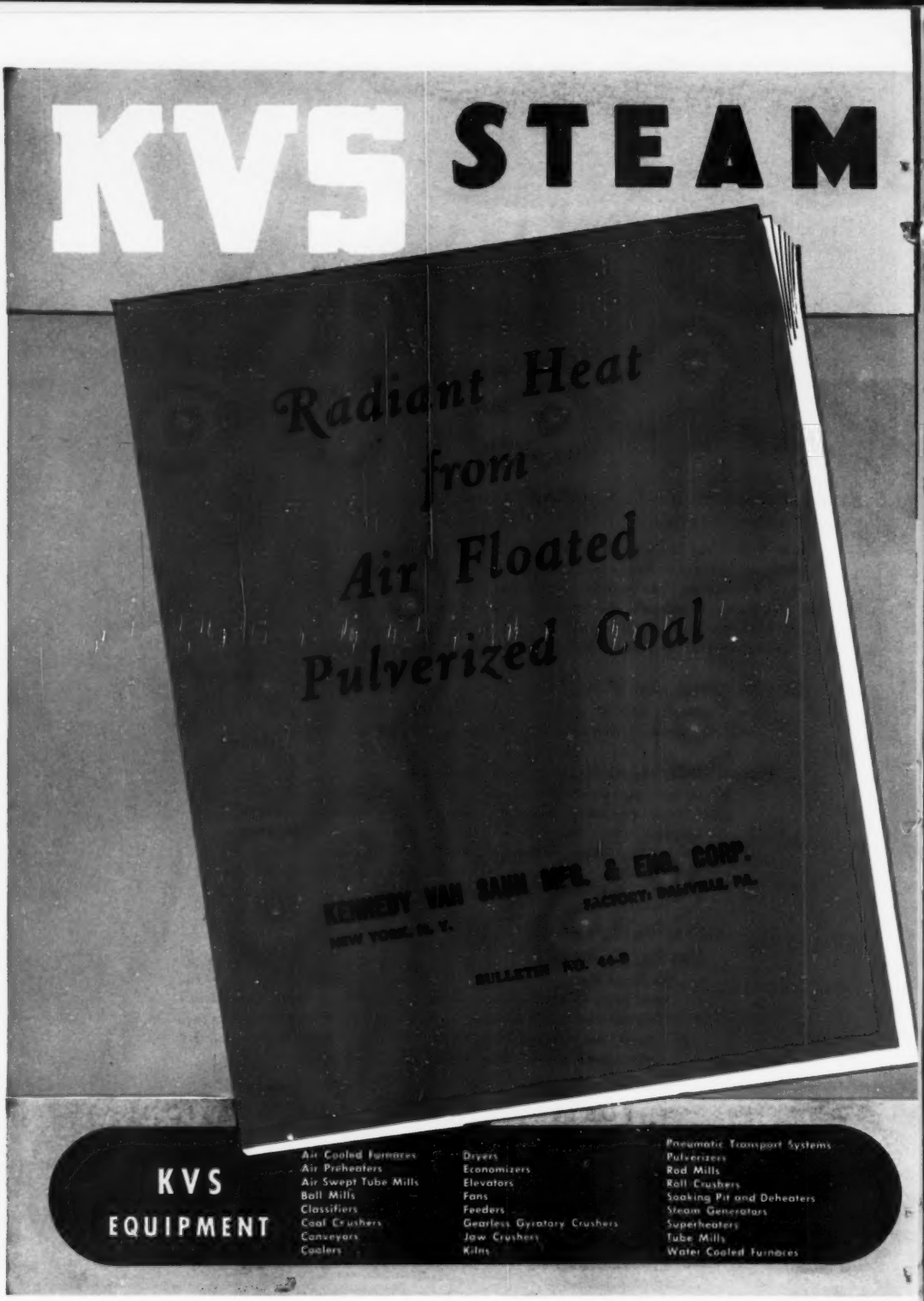
Other Foster Wheeler Fuel and Labor Saving Features

The design also embodies Foster Wheeler features of slag-free furnace arrangement, Foster Wheeler condenser-type steam temperature control, minimum baffles, low draft loss, and efficient heat recovery arrangement. When additional furnace cooling is required, the "Preferred Standard" design may readily incorporate a water cooled division wall.

For additional information, write . . .

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER


KVS STEAM
Radiant Heat
from
Air Floated
Pulverized Coal
KENNEDY VAN SAUN MFG. & ENG. CORP.
NEW YORK, N. Y.
FACTORY: DANVILLE, PA.
BULLETIN NO. 44-B
KVS
EQUIPMENT
Air Cooled Furnaces
Air Preheaters
Air Swept Tube Mills
Ball Mills
Classifiers
Coal Crushers
Conveyors
Coolers
Dryers
Economizers
Elevators
Fans
Feeders
Gearless Gyratory Crushers
Jaw Crushers
Kilns
Pneumatic Transport Systems
Pulverizers
Rod Mills
Roll Crushers
Soaking Pit and Deheaters
Steam Generators
Superheaters
Tube Mills
Water Cooled Furnaces

GENERATION

Fully described in this 97-page Engineering Handbook

Ask for Bulletin 44-B

PARTIAL LIST OF CONTENTS:

- . . . . How to pulverize coal for lower steam costs.
- . . . . The Air Swept Mill. Importance of "85/200" pulverization.
- . . . . Radiant Heat and what it means in combustion.
- . . . . Coal Distributors, Feeders and Burners.
- . . . . Pulverized Coal Steam Generators.
- . . . . Design of Air-Cooled and Water-Cooled Furnace Walls.
- . . . . Reports of Pulverized Coal Steam Generator Operation and Performance.
- . . . . Typical Steam Generator Designs for maximum performance in the use of Pulverized Coal, Oil, Gas and Waste Products.
- . . . . Modernization of Steam Generating Equipment.

These and many other subjects, equally important to power plant engineers, are authoritatively presented in this Handbook. All factual information is based on long, specialized experience in the field of steam generation and should prove invaluable to anyone concerned with modern steam plant design and economy.

Send for your Copy TODAY

FULLY Illustrated...

Kennedy Products

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

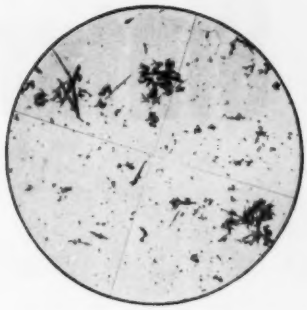
2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

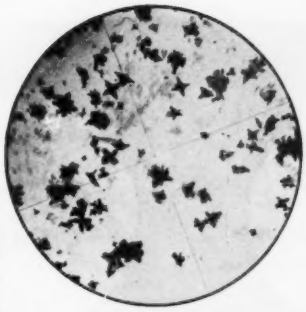
CANADA • ENGLAND • FRANCE • AUSTRALIA

"Looking into

your boiler's past —to protect its future"



Above: Chemical test for copper—brilliant yellow needles and clumps.



Left: Similar test for zinc—white crosses.

There is nothing particularly dramatic in the appearance of the optical microscope—even the special polarizing type used in Hall Laboratories. Nevertheless, the microscope is one of the most important instruments for studying scales and sludges, in order to determine what has happened and what may happen in your boiler.

Microscopic examination of boiler deposits has several functions. In some cases, microscopic examination alone will give analyses sufficiently accurate for the purpose; in other cases this examination serves as a guide to the chemical analysis. When necessary, microscope examination and chemical analysis "team up" with other procedures to reveal facts which make it possible to determine the causes of boiler trouble and to prescribe remedies for them.

Many substances may be precisely identified under the microscope by their optical properties alone. When the crystals are too tiny for individual measurement, important information may still be obtained through microscopic observation of their reaction to various chemicals.

An example of this type of study is illustrated by the photographs on this page. If a zinc compound is present, treatment with the proper reagents will cause the formation of white dots which gradually lengthen to a cross. Finally the cross "feathers out," assuming the form shown in the photograph. Copper compounds react with the same reagents, giving yellow needles and clumps instead of white, feathery crosses.

These are only a few of the types of information which the microscope gives, and the microscope is only one of the many tools used by Hall Laboratories in its service to hundreds of plants, large and small, in all parts of the country.

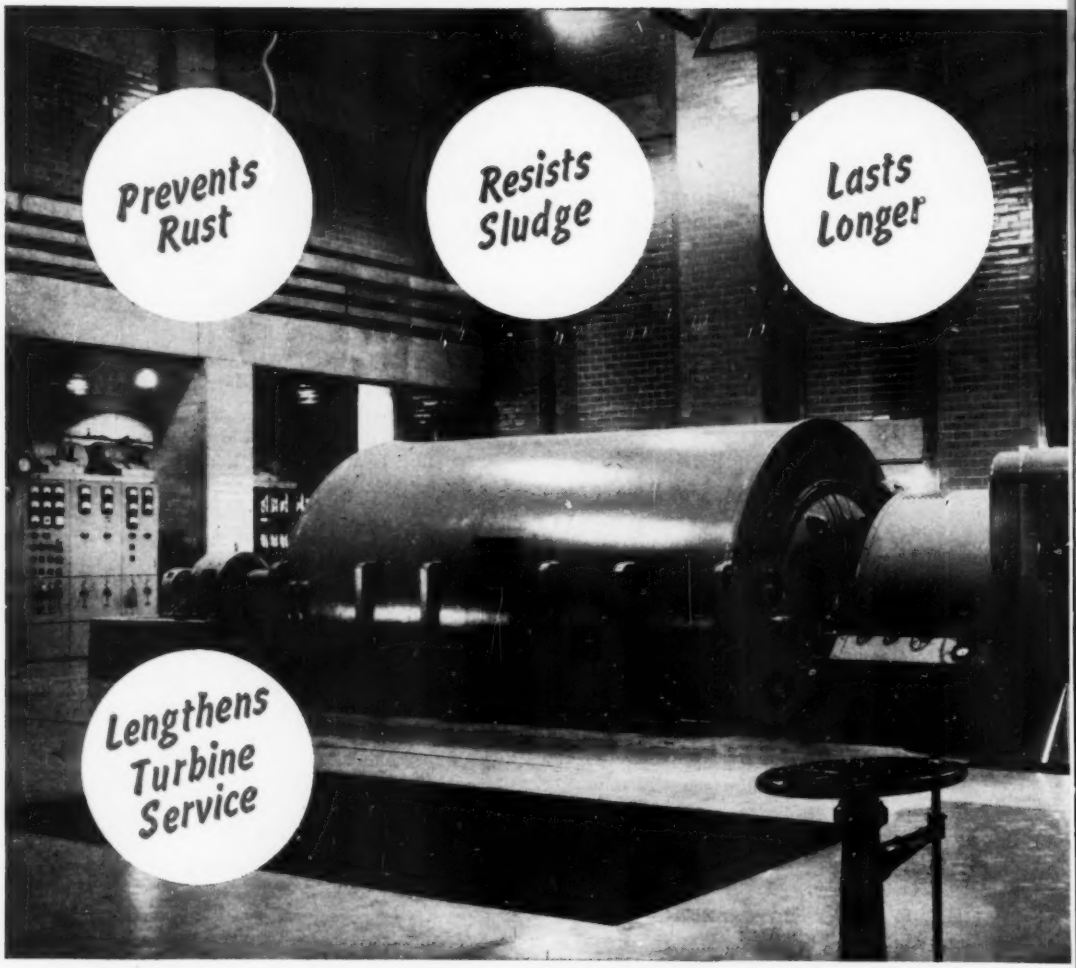
Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania.

HALL LABORATORIES, INC.

(A Subsidiary of Hagan Corporation)

CONSULTANTS ON
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL

Sinturlite Oils Retard Uninterrupted



SINCLAIR

YOUR NEAREST SINCLAIR AGENT WILL GLADLY ARRANGE

Oxidation To Give Steam Turbine Service

One of the problems in steam turbine operation is the build-up of acidity in the lubricant due to oxidation. This causes harmful sludge to clog passages and impair the proper functioning of the governor.

This problem is solved when Sinclair SINTURLITE OILS are used. SINTURLITE OILS are fortified to resist oxidation and resultant acidity, retarding the formation of sludge. Other additives protect against rusting. The system is always clean, including the oil lines, bearing clearances and intricate governor mechanism. Try Sinclair SINTURLITE OILS.

Continual research explains the high quality of SINTURLITE and other Sinclair Oils. Sinclair has recently completed at Harvey, Ill., one of the most modern and complete laboratories for petroleum research and development.

E. W. Isom, Sinclair Vice-President in Charge of Research says: "With the new facilities now made available to us at Harvey, Ill., we expect to find many ways to help industry cut costs through better petroleum products."

INDUSTRIAL OILS

FOR LUBRICATION COUNSEL, OR YOU MAY WRITE TO SINCLAIR REFINING COMPANY, 630 FIFTH AVE., NEW YORK 20, N.Y.

FREE AIR? ...NOT

Fig. 1840
Air Nozzle
Available with
various tips

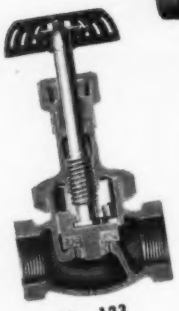


Fig. 123
N-M-D Valve
Non-Metallic Disc

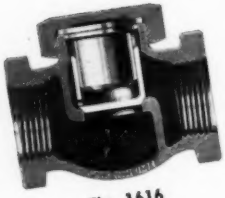


Fig. 1616
Air Compressor
Check Valve . . .
Hollow Stainless
Steel Disc

Fig. 1227
Pop Safety Valve
for Air

Stop those air leaks now. Your Lunkenheimer Distributor has a stock of Cocks, Globe and Angle Valves, Nozzles, Safety Valves, Check Valves, Tips, Nipples and other fittings for your needs. *Write for Circular No. 587 and enlarged copy of air leak chart, suitable for posting.*

LUNKENHEIMER VALVES

ON YOUR LIFE!!

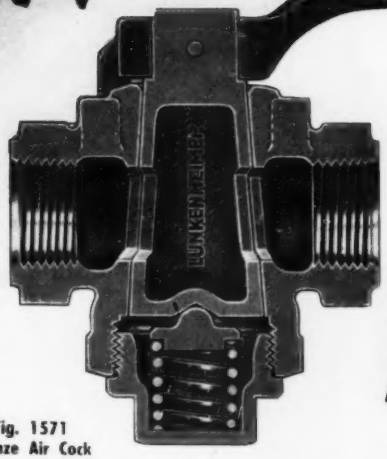


Fig. 1571
Bronze Air Cock

COMPRESSED AIR IS A VALUABLE TOOL...
but costly if wasted!
SAVE IT WITH LUNKENHEIMER AIR DEVICES

That h-i-s-s-s-s-s you may hear around your air lines means there's a villain loose in your plant. Costly compressed air is escaping, costing you money by the minute. But, you say . . . "it's only a pinhole, can't amount to much." Look at the chart below.

A SMALL LEAK MAY COST YOU AS MUCH AS $5.82 A MONTH

AREA OF LEAK	AIR	
Diameter Inches	Number of cubic feet per month at 75 lb. pressure	Total cost of waste per month 11c per 1000 cubic feet
1/4"	3,366,990	$ 370.37
1/8"	824,570	$ 90.70
1/16"	213,000	$ 23.43
1/32"	52,910	$ 5.82

Check your plant . . . compressed air leaks mean that good dollars are "gone with the wind." Replace leaky or defective air devices with LUNKENHEIMER Air Cocks, Valves, Nozzles. Designed for air line service, LUNKENHEIMER Air Devices seat tight and stay tight, requiring minimum maintenance for long, efficient service life.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO. U. S. A.

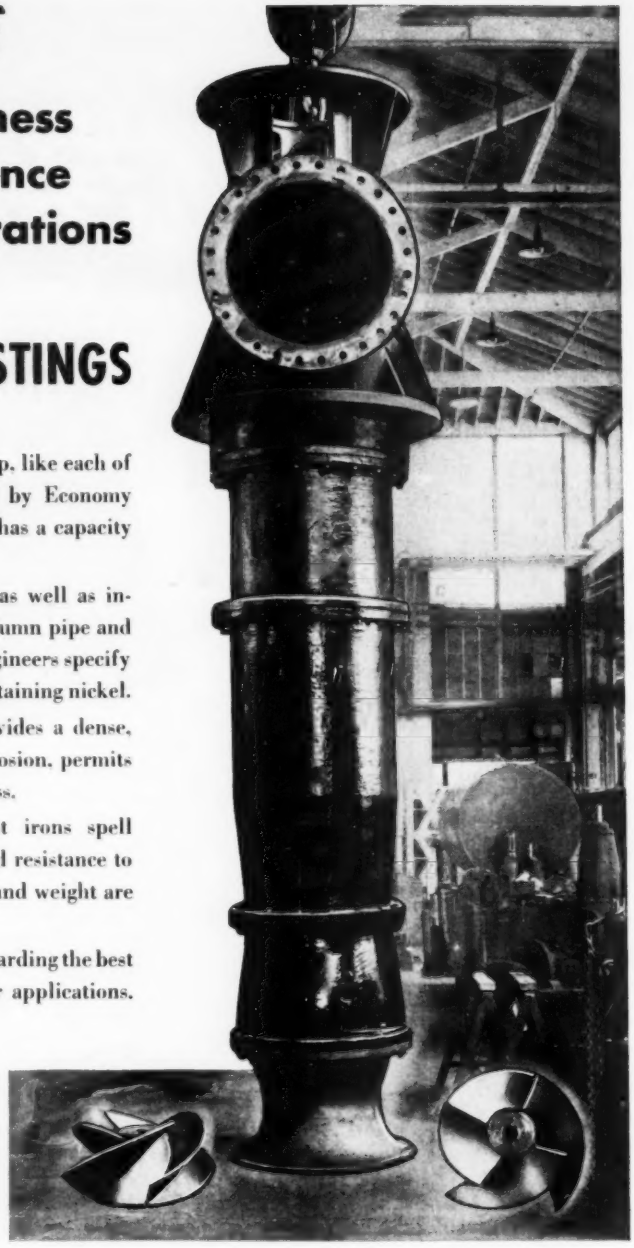
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

IMPROVE

★ Pressure Tightness
★ Erosion Resistance
in pumping operations with

NICKEL IRON CASTINGS



This large condenser circulating pump, like each of three similar units being furnished by Economy Pump Company of Hamilton, Ohio, has a capacity of 25,000 gallons per minute.

For improved erosion resistance, as well as increased strength and toughness in column pipe and discharge elbows, Economy Pump engineers specify these parts in a high test cast iron containing nickel.

This type of nickel cast iron provides a dense, close-grained structure that resists erosion, permits increased loads and pressure tightness.

Throughout industry, nickel cast irons spell economy when you need strength and resistance to erosion, or where savings in section and weight are important.

Write for our recommendations regarding the best nickel alloyed iron or steel for your applications.

Built for corrosive sea water service in a central pumping station on the east coast, this pump utilizes nickel alloyed iron and steels to assure long, dependable performance. Nickel cast iron is used for column pipe and discharge elbows. Impellers and suction bells are of 25% chromium—12% nickel stainless steel . . . and pump shafts, of "18-8" stainless.

EMBLEM OF INCO SERVICE
TRADE MARK

Over the years, International Nickel has accumulated a fund of useful information on the properties, treatment, fabrication and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes, nickel silver, cupro-nickel and other alloys containing nickel. This information is yours for the asking. Write for "List A" of available publications.

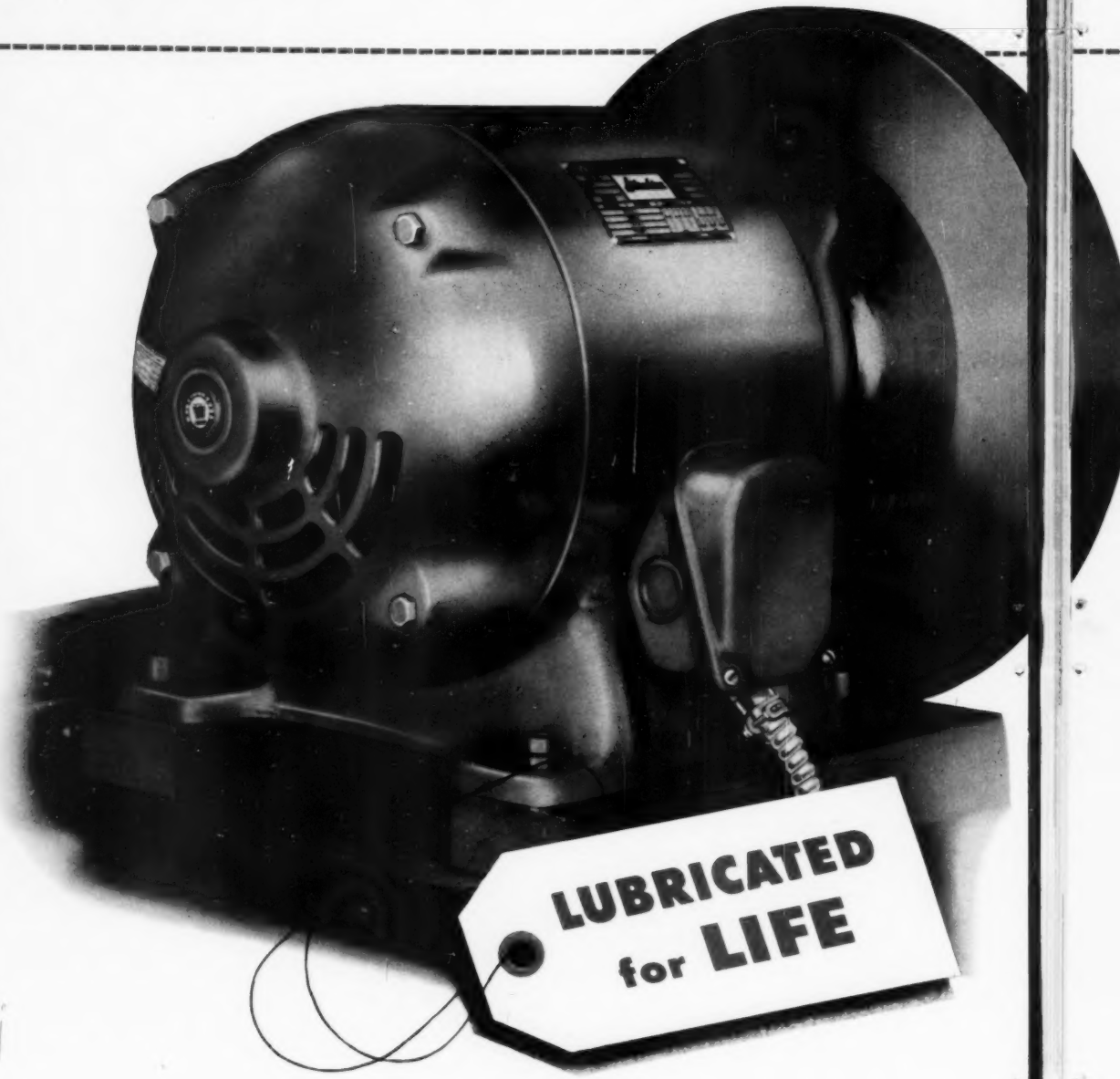
THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

Life-Line

NOW... LUBRICATED for LIFE

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



do away with lubrication costs

FOREVER

Forget old-time ideas about the care and greasing needed to keep motors running!

Life-Line motors now eliminate the time and cost required for lubrication—for life! Life-Line double-width ball bearings are pre-lubricated with a more-than-ample supply of specially-treated lubricant—and factory-sealed to keep dirt out and grease in, for *the life of the bearing.*

Periodic weekly or monthly greasing schedules can be dispensed with. Motors may be installed in inaccessible locations; machines no longer need be disassembled to reach motors for greasing. Winding failures caused by overlubrication, and failures caused by use of improper lubricants, can be prevented.

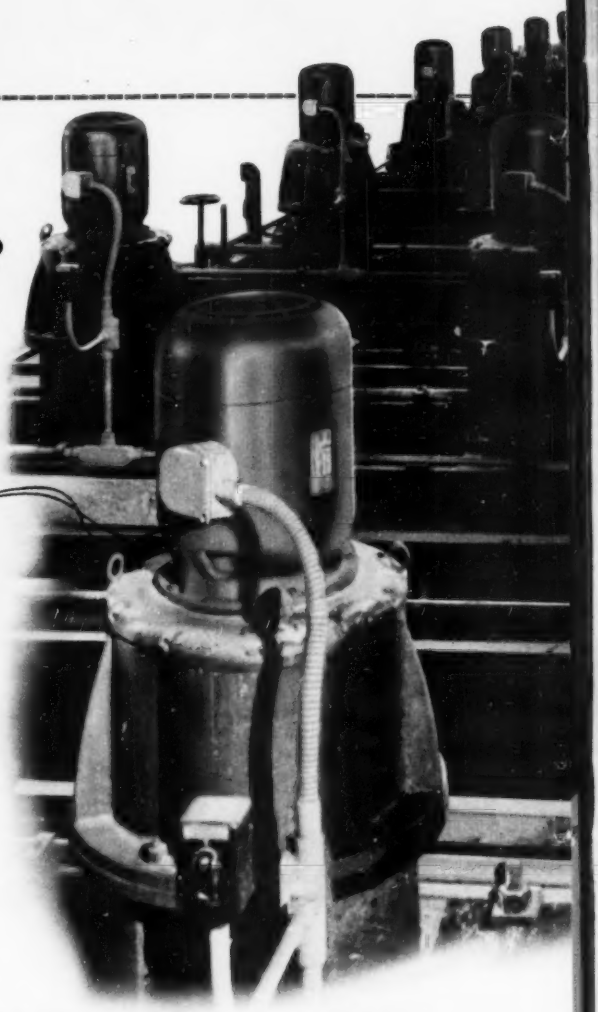
Multiply these advantages by the number of motors in *your* plant. You'll find they offer new and important savings—in labor costs, in machine down-time, in motor outage costs. Then get in touch with your nearest Westinghouse office today. Most standard Life-Line motors are now available from stock. Others are available on short delivery schedules. Ask for details on your requirements. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

Westinghouse Life-Line Motors

WESTINGHOUSE

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Tough lubrication job?

NOT WITH MOTORS

LUBRICATED for LIFE

It costs money to "baby" electric motors with constant greasing attention, whether it's a few or a few hundred.

That's why Life-Line motors offer new and important savings in plants like this one using 119 Life-Line vertical motor drives, and in any others using a-c motors from 1 to 50 horsepower.

Life-Line motors cut down operating costs every day, every week, they are in service, because they need *no* lubrication—*for life.* Sealed, pre-lubricated bearings insure long life—reduce motor outages caused by overlubrication and underlubrication—reduce machine shutdowns and lost production.

Check your Westinghouse representative today for prices and delivery on your requirements. Standard ratings available from stock—others on short delivery. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-21494

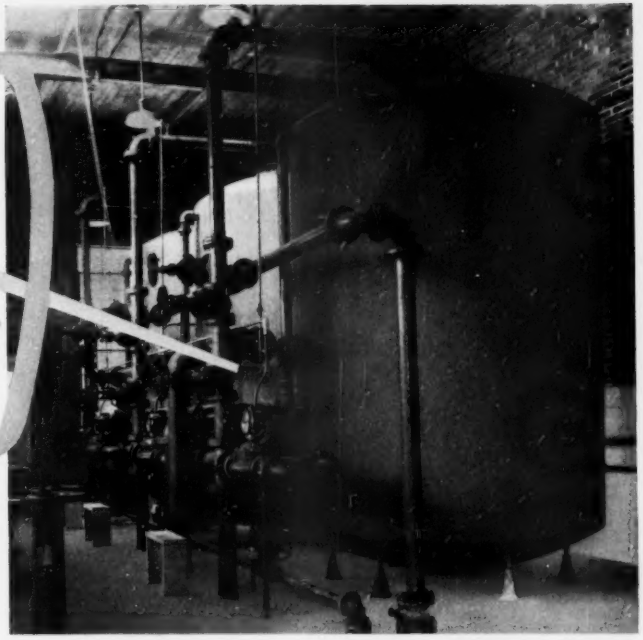
Westinghouse

Life-Line

Motors

Litho in U. S. A.

ZEOLITE is right for purifying water here...



Worthington installation of three 8′ — 0″ dia. Sodium Zeolite Softeners put into operation in August, 1948 at Virginia Woolen Co., Middlebury, West Virginia. Here raw creek water is alum treated, settled, filtered and softened. Virginia Woolen Co. constructed its own filters.

. . . but it may not be right for <u>your</u> water treatment

This Worthington Ion-Exchange plant was installed for purifying water in this case, *only* after scientific analysis by Worthington engineers determined that it was the most economical process for Virginia Woolen Co.

In your case, there are so many variables involved that a similar analysis would have to decide which water conditioning process is right for you. Even within the ion-exchange process itself, there are many variables: what ions you want to get rid of . . . calcium, magnesium, sodium, bicarbonate, sulphate or chloride; whether or not you want alkalinity removed; whether you want ionized water comparable to distilled water. *Only* scientific study of your particular water conditions can determine the right process for you.

WORTHINGTON KNOWS ALL FOUR PROCESSES

Out of Worthington's century-old experience in engineering water handling equipment has come more knowledge and skill in solving complicated water conditioning problems than you can get anywhere else. And since Worthington alone makes every essential part of all kinds of water conditioning systems, you get the extra advantage that comes from placing complete control and responsibility in the hands of one reliable manufacturer.

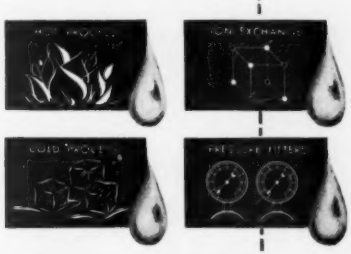
For complete details about the Worthington Ion-Exchange process, and further proof that *there's more worth in Worthington*, write for Bulletin W-212-B4. *Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, New Jersey.*

J8-8

WORTHINGTON

WATER CONDITIONING

Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



17 Years..ONE SET OF BELTS!

TEXROPE ENGINEERING skill and experience really paid off on this exciter drive. Installed in 1929, *not one cent* was spent on maintenance for over 17 years.

You can lower drive costs by putting a *Texrope* engineer to work on your drive problems. More *Texrope* V-belt drives have been installed in industry than any other kind, so *Texrope* engineers have solved problems like yours many times. Proof of their skill is in performance records like this.

Widest Range of Products — Only *Texrope* drives give you *everything* you need in V-belt drive equipment . . . belts . . . fixed and variable pitch sheaves . . . and speed changers. In every group the *Texrope* line offers the widest range of sizes and models.

Send for Pre-engineered Drive Manual — Vast *Texrope* experience has been condensed into 144 page book that covers 90% of all V-belt drives. See your Allis-Chalmers Authorized Dealer or District Office or write today. Ask for Bulletin 20B6956. Also listed in Sweet's.

Texrope Super-7 V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices. *Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks. A 2593

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and District Offices throughout the country.

MOTORS — ½ to 25,000 HP and up. Matching Allis-Chalmers Control.

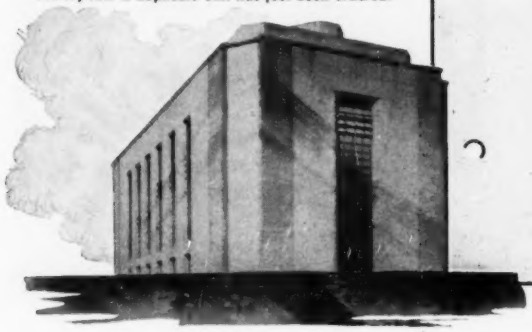
TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

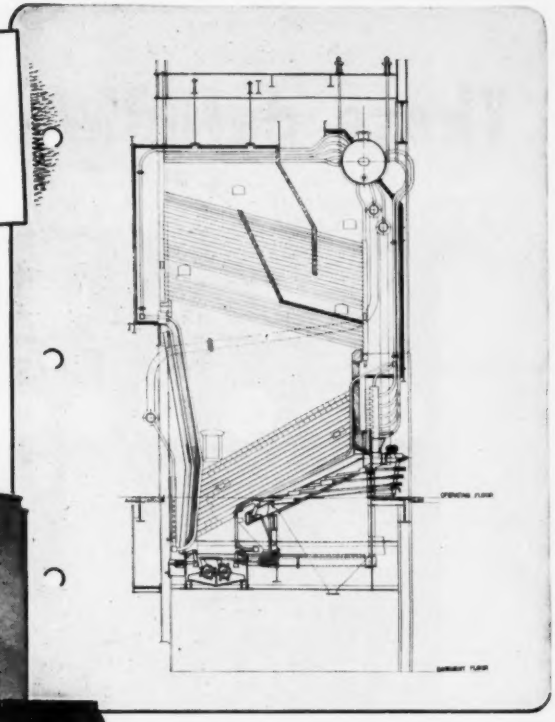
PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

Higher Efficiency On Lower Grade Fuels Made Available to Government Heating Plant

● *Modern heating plant in nation's capital has two water cooled Taylor Multiple Retort Underfeed Stokers. These units are designed to handle 150,000 lbs. per hour normal steam flow, and 240,000 lbs. per hour peak load. Furnishing steam heating to the Government building system, these stokers offer the ultimate in fuel flexibility.*

Performance of these two units has been so satisfactory that a duplicate unit has just been ordered.





POWER PLANTS throughout coal burning areas are installing the Taylor Stoker to permit the burning of today's coals with freedom from smoke and objectionable stack discharge.

Designed with simplicity as the keynote, Taylor has lower boiler outages, fewer moving, longer wearing parts. A unique precision pusher stroke control mechanism and better air flow are two more exclusive Taylor features that aid in giving you efficient, low-cost steam generation and trouble-free operation.

Backed-up by more than 45 years of engineering "know-how," these and other distinctive advantages make Taylor the time-tested, proven, economy stoker for both original and repeat installations.

Before you decide on any fuel-firing equipment for *your* power plant, see for yourself why the "trend is toward Taylor"—it's the stoker of proven performance.

FREE

This "fact-packed" booklet on the improved Taylor Stoker.

If you aren't up-to-date on stokers, write for your copy of this descriptive booklet today!

TAYLOR STOKER

A PRODUCT OF

AMERICAN ENGINEERING COMPANY

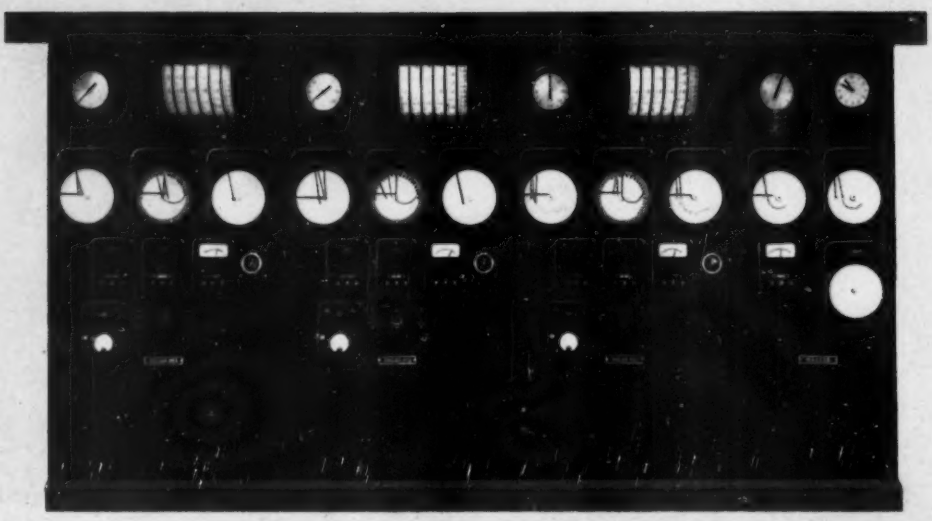
2400 ARAMINGO AVENUE, PHILADELPHIA 25, PENNSYLVANIA

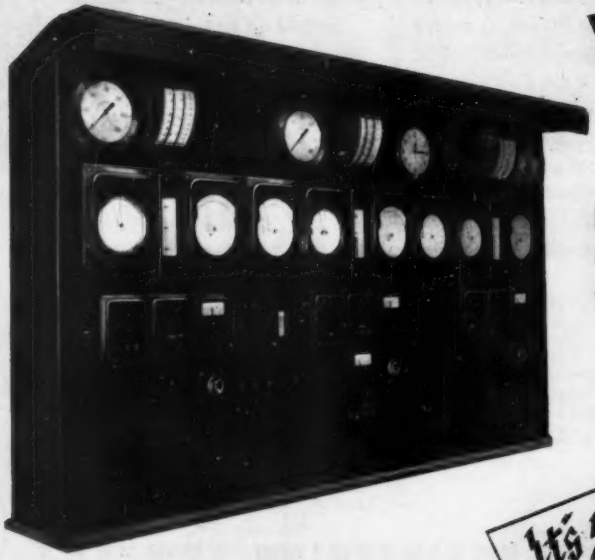
New York Office—75 West Street, N.Y., N.Y.

In Canada: *Affiliated Engineering Corporations Limited, Montreal and Toronto*

OTHER Æ PRODUCTS—Perfect Spread Stokers—Lo-Hed Electric Hoists & Car Pullers—Marine Deck Auxiliaries—Hele-Shaw Fluid Power

These definite benefits can be





It's Modern

Economical for all sizes of plants burning all types of fuel.

It's Electrical

yours . . . *with* HAYS *Automatic* COMBUSTION CONTROL

Steam pressure is maintained practically constant under wide variations in steam demand.

√ Correct fuel-air ratio is maintained for most efficient combustion.

√ Over-fire draft is maintained constant at a predetermined value.

√ Fuel-burning rate is kept in step with steam demand.

√ Furnace and boiler are protected by the more uniform firing conditions and by the smaller fluctuations of steam pressure and furnace temperature.

√ More uniform pressure improves turbine room efficiency and protects the quality of processed products.

√ Fuel and maintenance costs are definitely lowered.

√ ***Electrical operation*** makes for simplicity in installation, operation and maintenance.

√ Uniform high efficiency and CO_2 in the flue gas are maintained over a wide range of rating

√ Corrections are made before conditions get out of hand.

√ Always on the job, never tires, never forgets.

√ Clinker trouble is lessened. Periods of unnecessarily high combustion rates so common with hand control, are eliminated.

√ Smoke is reduced to the minimum and clogging of tubes practically eliminated.

√ Load variations can be carried by the entire battery of boilers or by an individual boiler, as desired.

√ Entire system or any individual controller may be operated manually from the panel at the flip of a switch.

√ Operator is relieved of many details, leaving him free to attend to more important duties in the boiler room.

√ As a matter of sound management, read Hays Bulletins 47-605 and 46-448—useful aids in cutting steam costs. Write for them—no obligation.

HAYS *Automatic* COMBUSTION CONTROL

INDUSTRIAL CONTROL • FLOWMETERS • GAS ANALYZERS • DRAFT GAGES • CO_2 RECORDERS

THE HAYS CORPORATION, MICHIGAN CITY, INDIANA

I PROVIDE

TWO-WAY PROTECTION FOR YOUR POWER PLANT

"I am De Laval Centrifugal Force. I remove ***both*** contaminants of lubricating oil—dirt and water—and thus keep the oil both clean and dry.

"Engineers never worry about contamination in their lubricating oil when my centrifugal force protects their power units. Whether it is a turbine where condensate is as apt to be the problem as dirt is, or a Diesel engine where carbon and other solids are most important, a De Laval "Uni-Matic" Oil Purifier will provide unfailing protection.

"Fuel oil, too, gives better heat value when impurities are first centrifuged out. Diesel engineers know that centrifugal force can be more than lubricating oil protection — it can help get the full BTU value out of every drop of oil."

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DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
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DE LAVAL *OIL PURIFIERS*

FOR MORE DEPENDABLE POWER PRODUCTION

Get Action LIKE THIS:

★ **24 hours to make and install coils in 250 HP motor**

★ **Rebuilt 250 HP slip ring motor in 2½ days**

★ **3 days to rebuild 125 HP motor including 200 miles of truck shipment**

THESE ARE ACTUAL JOBS turned out by Giles Armature and Electric Works, Marion, Illinois . . . the kind A-C Certified Service Shops are doing every day!

When every hour costs money . . . when production is stopped . . . Allis-Chalmers Certified Service on motors, transformers, pumps, etc., can get you rolling again, *fast*. Dependable for prompt service on routine work, too.

Call Your A-C Office or Dealer. A-C Certified Service Shops are hand-picked, independent repair shops meeting rigid standards for equipment, trained personnel and business reputation for square dealing. For the one nearest you, ask your Allis-Chalmers Dealer or District Office.

Check with us for *new* motors too. Stock or quick delivery on many sizes, types.

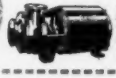
Texrope and *Vari-Pitch* are Allis-Chalmers trademarks. A 2594

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and District Offices throughout the country.

MOTORS — ½ to 25,000 HP and up. Matching Allis-Chalmers Control.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

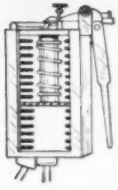


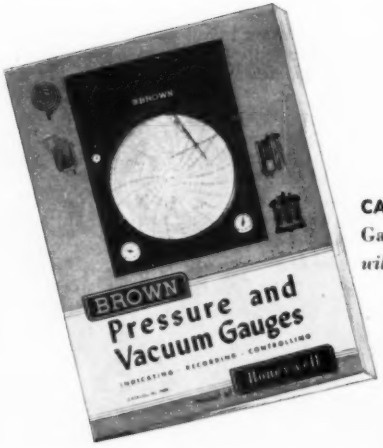
PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Here's where to start for





CATALOG 7000, "Brown Pressure and Vacuum Gauges," *is complete and informative. A copy will be sent to you upon request. Write today!*

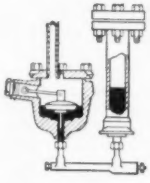
PRECISE PRESSURE CONTROL

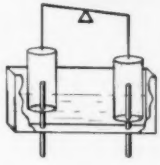
These measuring elements are the heart of Brown pressure control systems for better processing... because precision control starts with precise measurement!

Complete coverage of pressure problems necessitates this complete line of elements.

There's a specific one for each application... from microns to tons... from corrosive to non-corrosive! They make Brown Pressure Gauges *the finest available to industry.*

You'll find detailed information in Catalog 7000... send for it today.





MINNEAPOLIS-HONEYWELL REGULATOR CO.
BROWN INSTRUMENTS DIVISION
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Offices in principal cities of the United States, Canada and throughout the world

BROWN *Advanced Instrumentation* FOR BETTER PROCESSING
Product of MINNEAPOLIS Honeywell

For conveying rock to the site of Bull Shoals Dam—a flood control and hydroelectric project.

Those idlers or "rollers" you see above are a vital part of the longest conveyor system in existence.

13,888 of them stretch all the way from Lee's Mountain down to Bull Shoals dam site on the White River in Arkansas, seven miles away.

Now in operation, with the conveyor belt in place, each idler shown above must support the movement of nearly ten tons of crushed rock every minute! Before the Bull Shoals Dam is completed, 4,000,000 tons of limestone will have moved over these Robins Idlers!

The engineers in charge knew that these idlers—made by Hewitt-Robins—could handle this great tonnage . . . and then some. That's because the rigid truss design of Robins Idlers is *stronger than any other type of construction!*

Moreover, they knew that seven miles of idlers, rolling day and night, must be sound in design. And Robins Idlers—with patented One-Shot Lubrication and Triple Grease Seal—*roll longer—take less care, less grease.*

This seven-mile roller coaster is only one of thousands of belt conveyors equipped with Robins Idlers.

Hewitt-Robins is the only company that is prepared to engineer, build, and install both machinery and belting *as a single unit.*

HEWITT ROBINS

CONVEYORS

Whether you want machinery, belting, or a belt conveying system, consult Hewitt-Robins.

HEWITT RUBBER DIVISION, BUFFALO 5, N. Y.
ROBINS ENGINEERS DIVISION, N. Y. 7, N. Y.
ROBINS CONVEYORS DIVISION, PASSAIC, N. J.

ROBINS CONVEYORS DIVISION **HEWITT-ROBINS INCORPORATED**

For Heavy Duty Steam Generating Plants

Springfield's

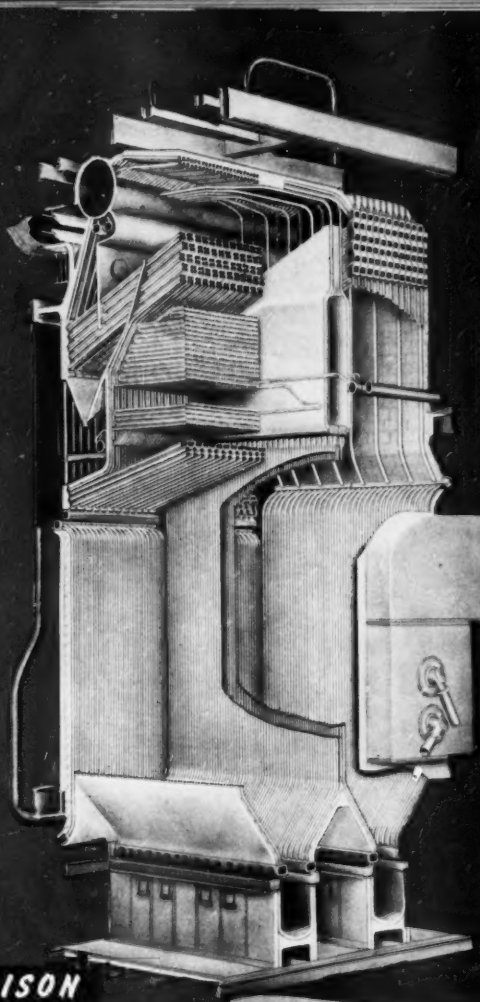
DIVIDED FURNACE WITH CENTER WATER WALL

THE divided furnace with a CENTER WATER WALL* is a development first introduced by Springfield Boiler Co., for large central station installations. It has application where gas temperatures entering the first pass and superheater must be limited to prevent overheating of the center section of the wider furnaces. It enables a unit to stay on the line longer before shutting down for maintenance and cleaning.

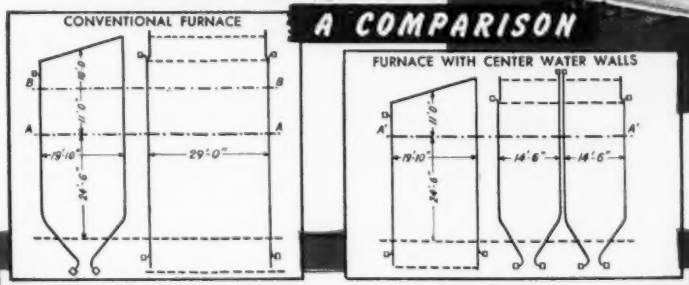
The divided furnace construction has been highly dependable and successful in service. It is adaptable to any kind of firing. Springfield offers it on both bent tube and straight tube boiler designs.

*Patented

CHECK WITH YOUR CONSULTING ENGINEER ON YOUR MODERNIZATION AND NEW PLANT PROJECTS



A COMPARISON



These diagrams show how the *center water wall* made it possible for Springfield to reduce the height of furnace 22% on one 350,000 lb. pulverized coal fired unit in addition to securing a more even gas temperature entering the first pass across the width of the unit.

SPRINGFIELD PRODUCTS

BENT TUBE STEAM GENERATORS—Modern designs for capacities from 10,000 lbs. up.

STRAIGHT TUBE BOILERS—Specially designed for capacities from 5,000 to 450,000 lbs. per hour and higher.

STANDARDIZED TYPE M BOILERS—Standardized for quicker delivery and lower cost. Sizes 6,000 to 17,000 lbs. per hour.

WATER COOLED FURNACES—Heavy duty water walls. Exclusive center water wall construction for larger units.

SUPERHEATERS — AIR HEATERS — ECONOMIZERS—Individually designed to meet requirements.

SPRINGFIELD BOILER CO.

1953 E. CAPITOL AVENUE SPRINGFIELD, ILLINOIS

Worldwide Sales and Service

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CHICAGO • SAN FRANCISCO • ST. LOUIS • CINCINNATI • MEXICO, D.F. • BUENOS AIRES

Export: READING, PA.

SPRINGFIELD BOILERS

See our catalog in SWEET'S

No job is too unusual for NAVCO

Whether you require a simple pipe bend or a complicated prefabricated assembly, Navco can help you. As shown above, Navco Shops are equipped to handle Chrome Moly, Stainless, Carbon Steel and Copper, in addition to any of the many other Ferrous and Non-Ferrous materials.

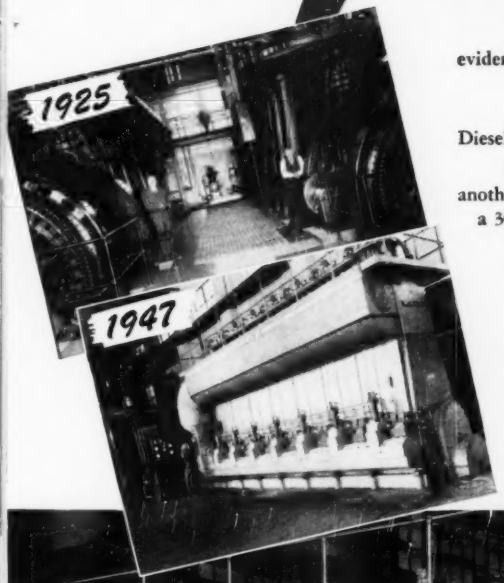
NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

4th NORDBERG DIESEL

for Marquette, Michigan



Experience of the City of Marquette, Michigan, is evidence of the versatility of Nordberg Diesel Engines in meeting fast-changing power requirements.

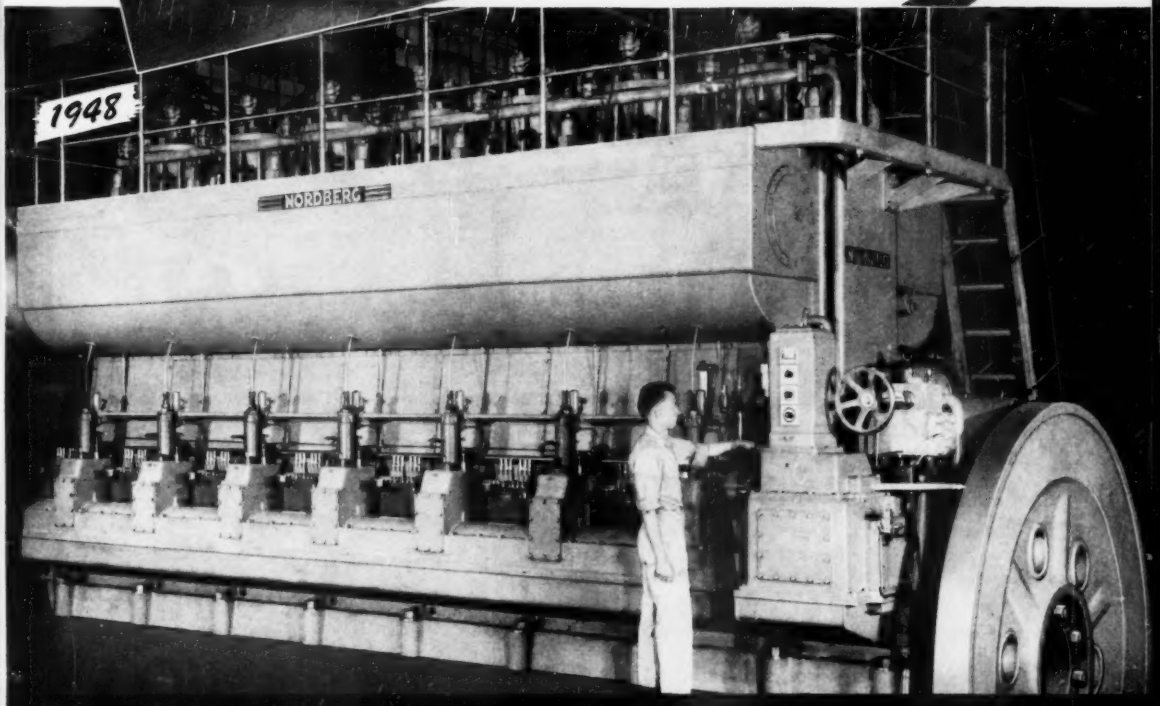
In 1925, during a serious power shortage, two Nordberg Diesels were installed in order to restore service quickly.

In 1947, needing an additional engine quickly to meet another power shortage, Marquette installed their third Nordberg—a 3000 H.P. unit. Since then, to help meet the power shortage which has continued to exist, their fourth Nordberg Diesel was shipped, and is now being installed.

For regular or emergency service, you can't beat the advantages of Nordberg Diesels . . . they can be added to the line quickly, and can be held ready for instant service without exorbitant standby expense.

NORDBERG MFG. CO.
MILWAUKEE 7, WIS.

P249



A DIVISION OF NORDBERG

NORDBERG
DIESEL ENGINES

NORDBERG MACHINERY

AVOID THE LUXURY TAX

on Idle Horsepower

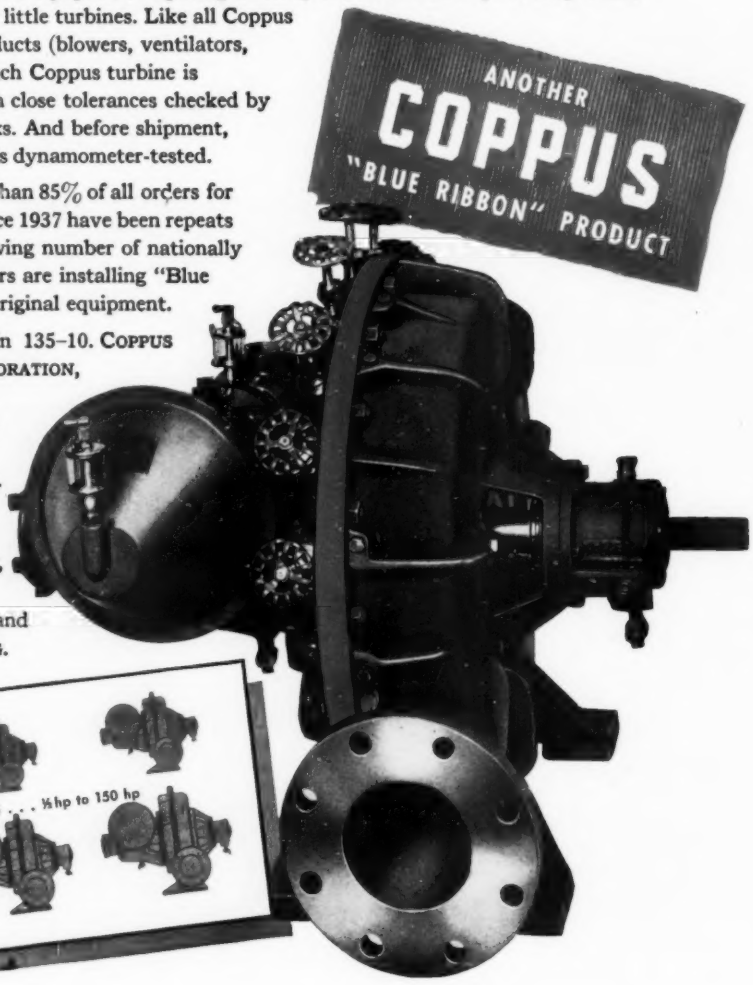
When your horsepower needs are small, why pay the extra cost of larger turbines, designed for much more power than you require?

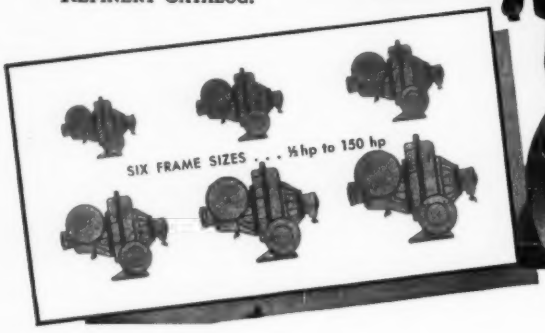
You pay only for the horsepower you need when you fit the right Coppus "Blue Ribbon" Turbine to the load. They're made in six frame sizes . . . from 150 hp down to fractional . . . priced in proportion to their size.

That's why you'll see more and more Coppus turbines powering pumps, blowers, fans, stokers and other equipment requiring a steady source of small hp. *Steady* is the word for these busy little turbines. Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.) each Coppus turbine is precision-made, with close tolerances checked by Johansson size blocks. And before shipment, the turbine you get is dynamometer-tested.

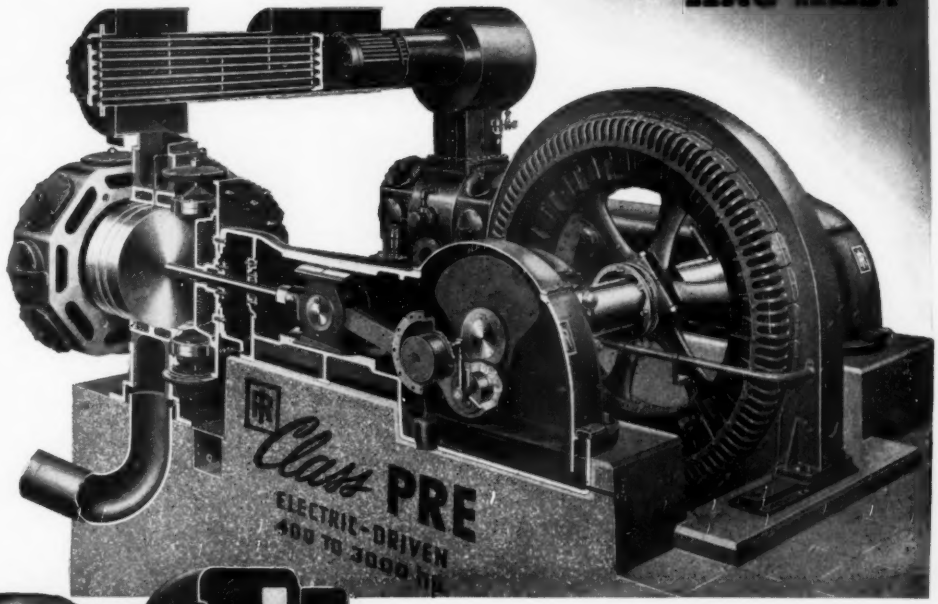
No wonder more than 85% of all orders for Coppus turbines since 1937 have been repeats . . . and that a growing number of nationally known manufacturers are installing "Blue Ribbons" on their original equipment.

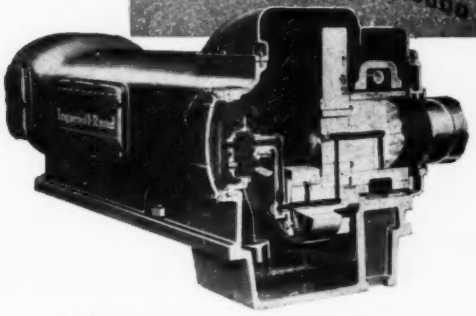
Write for Bulletin 135–10. COPPUS ENGINEERING CORPORATION, 162 Park Avenue, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG and REFINERY CATALOG.





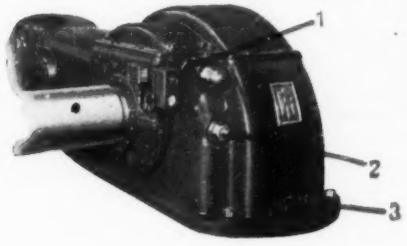
only Ingersoll-Rand makes a compressor like this!





Oil-pump drive and distribution system (patented) are combined to feed filtered oil directly to the crankpin, main bearings and crosshead.

Convenient Oil-control Center showing (1) main-bearing temperature indicator, oil-pressure gauge, and automatic oil-pressure protection, (2) main-bearing micrometer adjustment, and (3) oil filler cap.



Look at this full force-feed, filtered, lubrication system built entirely within a *sealed* crankcase which has no oil piping under pressure and no internal bearing adjustments. The machine *stays* clean inside . . . is *easy* to clean outside. Crankpin and crosshead-pin bearings are *full-floating*, precision-type, and pressure-lubricated. Main bearings have *micrometer* adjustment from *outside* the crankcase.

The PRE is equipped with Ingersoll-Rand's Air-Operated 5-Step Clearance Control, conceded to be the best method of regulating the output of large synchronous - motor - driven compressors. Efficient *Channel* Valves and economical *two-stage* intercooler reduce power cost and cut maintenance.

Let us tell you more about the "PRE" . . . the heavy-duty compressor in a class by itself. And remember, Compressors and Air Tools pay for themselves nearly twice as fast today.

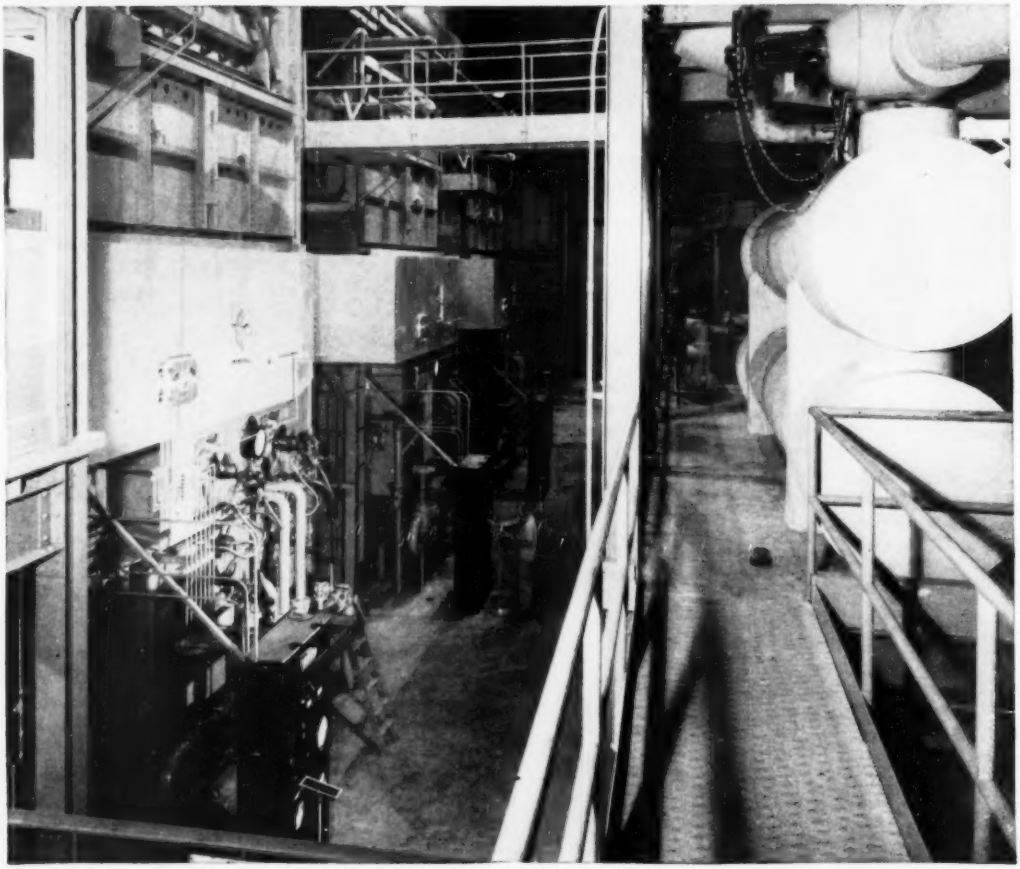
Ingersoll-Rand

11 Broadway, New York 4, N. Y.

344-1

AIR POWER
The Key to Lower Production Costs

Today—More Republic



Interior view of a 400,000 lb. steam generating plant in a modern industrial plant. Steam is generated in these gas fired boilers which are operated by a Republic automatic combustion control system.

The installation of Republic automatic controls on your boiler (or boilers) will enable you to:—

SAVE FUEL by automatically maintaining highest combustion efficiency.

INCREASE STEAM OUTPUT by operating the boilers at test efficiency 24 hours a day, 7 days a week.

CONSERVE MANPOWER by automatically performing the many routine repetitive adjustments.

REDUCE OUTAGES by maintaining uniform operating conditions and thereby prevent the chain-of-event type of trouble that frequently develops as a result of incorrect boiler operation.

REPUBLIC
INSTRUMENTS
AND CONTROLS

Combustion Control Systems

ARE BEING SPECIFIED THAN EVER BEFORE

because...

Built into the Republic combustion control systems are the many important features that enable it to fulfill all the conditions of theoretically perfect combustion control and still meet all the demands of everyday operation.

Check the following features against your list of "musts" when specifying a perfect combustion control system.

CENTRALIZED CONTROL:
The operation and control of the boiler or boilers is centralized at the master controller.

FUEL-AIR RATIO INDICATOR:
The master controller is provided with mercury manometers or gages which indicate the measured fuel and air inputs to the boiler and the fuel-air ratio.

FUEL-AIR RATIO ADJUSTMENT:
A handwheel on the front of the master control panel provides a convenient means for adjusting the fuel-air ratio.

FUEL VARIATIONS:
Automatically compensates for variations in fuel to maintain combustion conditions constant.

ALL BOILER RATINGS:
Maintains proper fuel-air ratio over the entire range of boiler ratings.

CONSTANT STEAM PRESSURE:
Maintains the plant steam pressure within narrow limits of variation by proportioning the fuel and air inputs to the load.

LOAD DISTRIBUTION:
Provides a means of distributing the load among the boilers as desired.

MANUAL CONTROL:
Boiler ratings can be controlled manually by a handwheel located on the front of the panel.

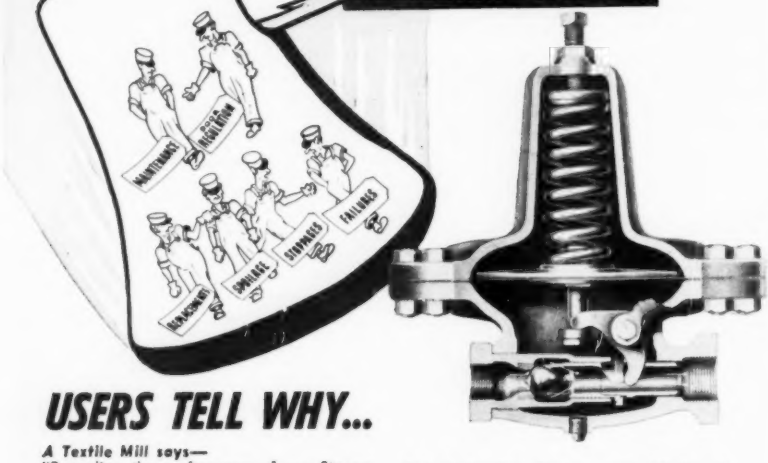
Find out about Republic control systems. One of our engineers will be glad to consult with you at any time without obligation on your part. Write us today.

Republic Flow Meters Co.

2240 Diversey Parkway • Chicago 47, Illinois

TROUBLEMAKERS "Get the Axe" IN PLANTS EQUIPPED WITH...

CASH STANDARD Streamlined TYPE 1000 PRESSURE REDUCING VALVES



USERS TELL WHY...

A Textile Mill says—
"Regarding the performance of our Streamlined Type '1000' Pressure Reducing Valves, we wish to state that we have a great many of these throughout the plant and are very pleased with them. We feel that they REDUCE COSTS and IMPROVE PRODUCTION, and we can therefore highly recommend them as they have always given us entire satisfaction."

A Laboratory says—
"The CASH STANDARD Type '1000' Streamlined Valves are the MOST SATISFACTORY VALVE we have ever tried. The slightly higher initial cost PAYS HANDSOME DIVIDENDS in LONGER SERVICE and LESS MAINTENANCE."

An Instrument Manufacturer says—
"The only thing that we can say about the CASH STANDARD '1000' Valves that we purchased from you is that the prompt service you gave us and the EXCELLENT PERFORMANCE OF THE VALVES really saved the day for us. THEY HAVE FUNCTIONED PERFECTLY ever since installation and NO SERVICE HAS BEEN NECESSARY."

A Steam Laundry says—
"Before we installed your type '1000' Valve in our air line, the variation in pressure kept the air valves on our presses out of order a great deal of the time. Now we carry 100 lbs. air pressure on our tank and let 70 lbs. out to our presses which CUT MAINTENANCE COST and SPEEDED UP PRODUCTION because we have NO LOST TIME due to valve failure. We have had this type '1000' Valve in service for two years and have never had it apart so we have had NO REPAIR COST."

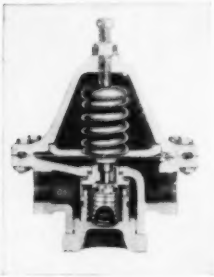
Bulletin 962
Shows why users check with these points and how you can realize them.

1. **Maximum capacity when needed most**
2. **Accurate pressure control under toughest working conditions**
3. **Trouble-free service.**
4. **Smooth operation.**
5. **Tight closure.**
6. **Speedier production results.**
7. **Elimination of failures.**
8. **Cost-saving operation.**
9. **No spoilage.**
10. **Practically zero in maintenance.**

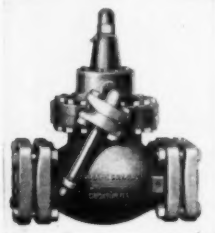
CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

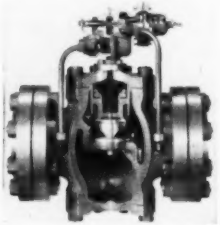
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES
Send for them



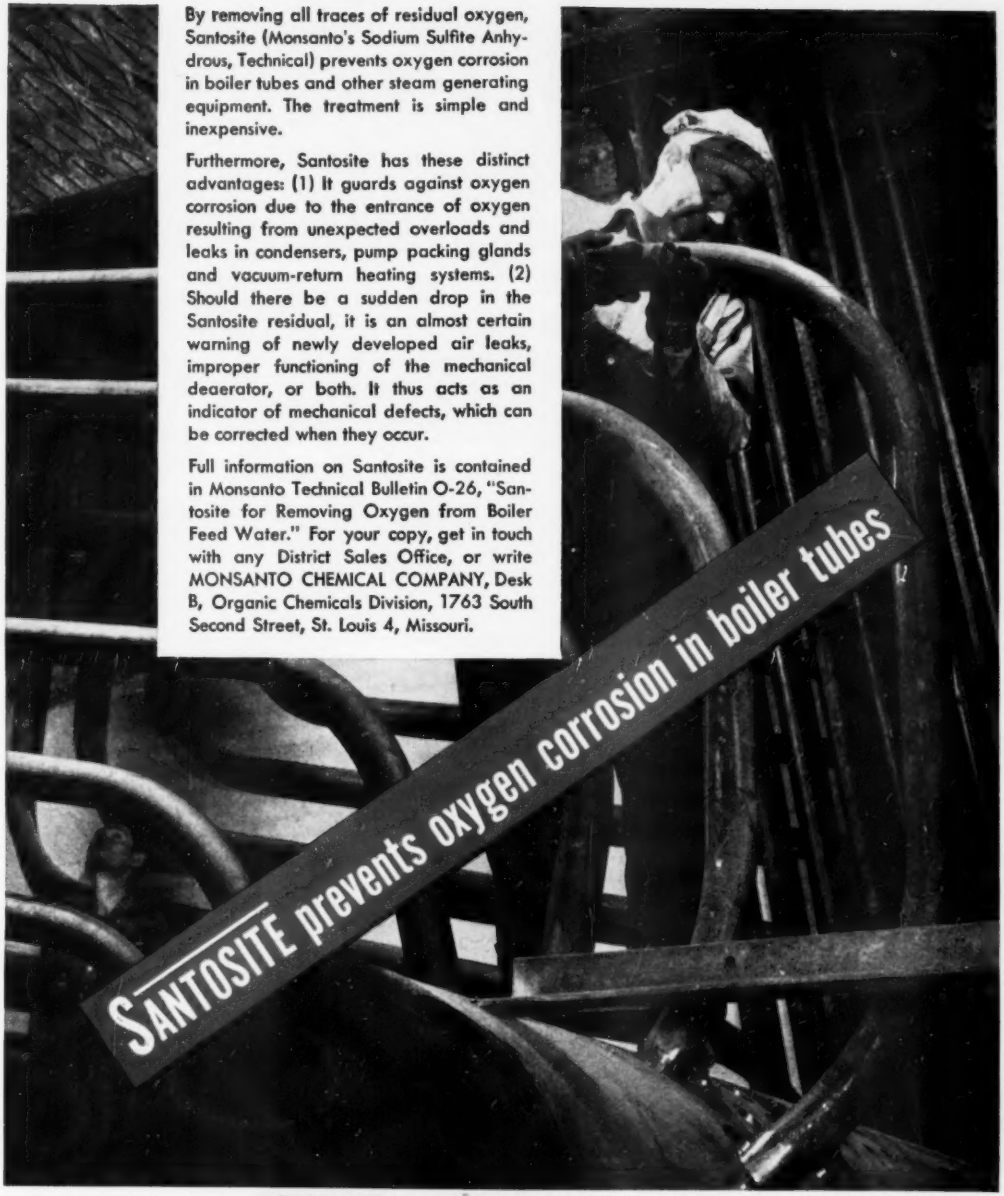
Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.



By removing all traces of residual oxygen, Santosite (Monsanto's Sodium Sulfite Anhydrous, Technical) prevents oxygen corrosion in boiler tubes and other steam generating equipment. The treatment is simple and inexpensive.

Furthermore, Santosite has these distinct advantages: (1) It guards against oxygen corrosion due to the entrance of oxygen resulting from unexpected overloads and leaks in condensers, pump packing glands and vacuum-return heating systems. (2) Should there be a sudden drop in the Santosite residual, it is an almost certain warning of newly developed air leaks, improper functioning of the mechanical deaerator, or both. It thus acts as an indicator of mechanical defects, which can be corrected when they occur.

Full information on Santosite is contained in Monsanto Technical Bulletin O-26, "Santosite for Removing Oxygen from Boiler Feed Water." For your copy, get in touch with any District Sales Office, or write MONSANTO CHEMICAL COMPANY, Desk B, Organic Chemicals Division, 1763 South Second Street, St. Louis 4, Missouri.

District Sales Offices: New York, Chicago, Philadelphia, Boston, Cleveland, Detroit, Charlotte, Birmingham, Houston, Los Angeles, San Francisco, Seattle, Portland. In Canada: Monsanto (Canada) Limited, Montreal.

Santosite: Reg. U. S. Pat. Off.

MONSANTO
CHEMICALS AND PLASTICS

MONSANTO CHEMICAL COMPANY
Desk B, Organic Chemicals Division
1763 South Second Street, St. Louis 4, Missouri

Please send me a copy of Technical Bulletin O-26 on Santosite.

Name_____ Title _____

Company_____

Address_____

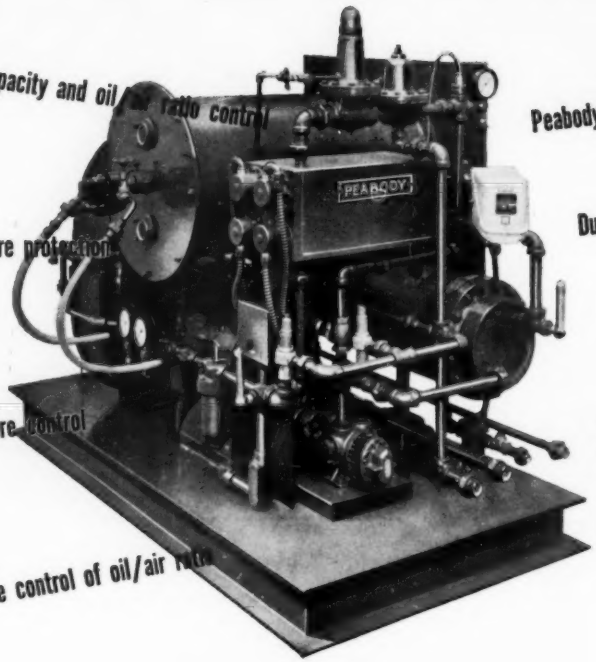
City_____ State_____

SERVING INDUSTRY . . . WHICH SERVES MANKIND

announcing

THE

PEABODY Automatic Oil



Automatic control of capacity and oil/air ratio control

Peabody Constant Differential System

Electric eye flame failure protection

Dual gas-electric ignition

Positive oil temperature control

No costly checker work floor, nor secondary air lanes under furnace walls and floor.

No field assembly, piping or electrical work.

Forced draft, positive control of oil/air ratio

Shipped as one complete factory-built unit, ready for

LISTED BY UNDERWRITERS LABORATORIES, INC.

An automatic wide-range oil-burning system assembled complete on one base for all types of boilers and furnaces from 100 developed HP and up!

Burner

Designed for fully-automatic and semi-automatic control!

THE Peabody Automatic Burner is a complete, compact, fuel-oil combustion system that takes heavy Bunker "C" or lighter fuel oil from your storage tank, pumps it to the required pressure, preheats and delivers it to the burner at the proper viscosity, ignites it and then burns the oil at the specified firing rate as dictated by operating demands.

The product of more than two years of research and development, the Peabody Automatic Burner is ruggedly constructed, safe and simple to operate, easy to maintain and dependable and efficient in operation. Quiet, slow-speed operation of pump eliminates excessive noise and high maintenance costs. Complete details on request, and specific application data available without obligation. Call or write our nearest office located in all principal cities.

Available Now! Send for Bulletin 400, Today

PEABODY
Engineering Corporation

PEABODY Engineering Corp.
580 Fifth Avenue, New York 19, N. Y.

Please send me Bulletin 400 giving details and specifications on the Peabody Automatic Oil Burner.

NAME ..... TITLE .....

FIRM .....

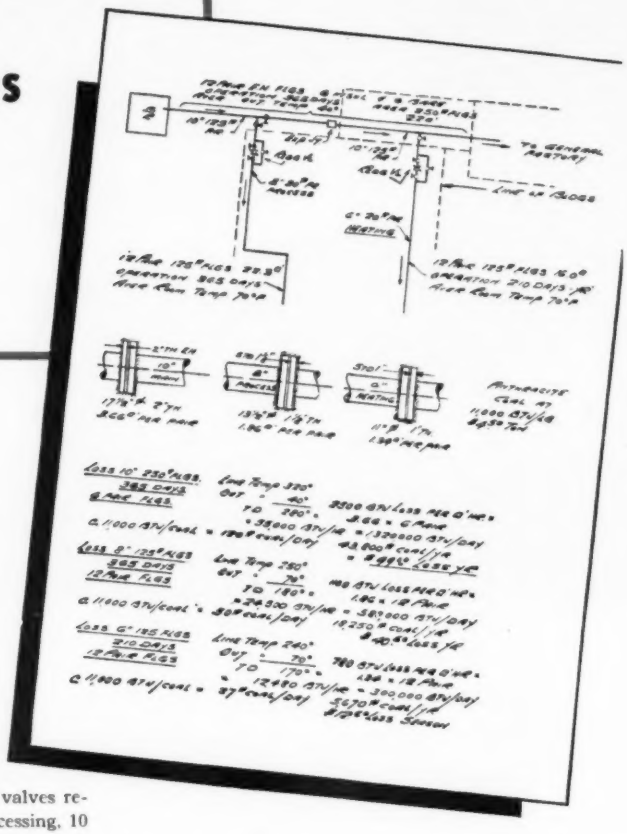
ADDRESS .....

CITY ..... ZONE ..... STATE .....

203

service connections

Which flanges would YOU insulate?



Here's what the Armstrong engineer recommended:

Fuel costs worried the engineer of a processing plant. His steam lines were insulated, but some of the flanges were not. Should he leave them bare or cover them?

The Armstrong engineer made a careful study of the situation, and a leaf from his notebook is shown here. He found main steam pressure was 125 lbs. (saturated). Regulating valves reduced this pressure to 30 lbs. for processing, 10 lbs. for heating. On main steam, there were 12 pairs of flanges, 6 of which already were insulated. There were also 12 pairs of flanges on processing lines, all bare; and 12 pairs of flanges on heating lines, all bare.

As his calculations show, the Armstrong engineer recommended that the remaining bare flanges on main steam be covered, also the flanges on processing lines. Flanges on heating lines could more profitably be left uninsulated. This kind of impartial study—not only of flanges but of every surface where heat losses are occurring—pays dividends under today's conditions. It can be done for you without charge or obligation by an Armstrong engineer from the nearest Armstrong district office.

If you should decide to install extra insulation, Armstrong will be happy to estimate its cost, using top-quality materials and its own skilled manpower. Often, the job can be done without interruption of production.

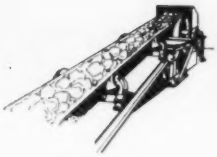
FREE INSULATION CHART This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write to Armstrong Cork Company, Industrial Insulation Department, 7002 Maple Avenue, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

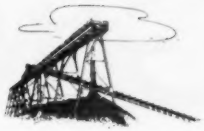
From 300° Below Zero

To 2800° Fahrenheit



BELT CONVEYOR

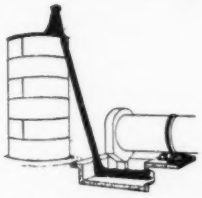
BELT CONVEYOR
TRIPPER
•
BELT CONVEYOR
ON BOOM



SHUTTLE TYPE
BELT CONVEYOR

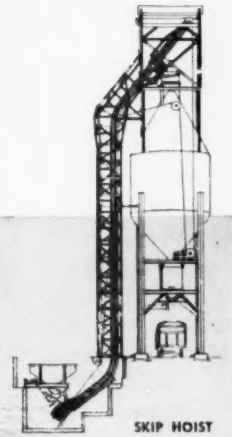
BELT CONVEYOR
STACKER
•
PORTABLE
BELT CONVEYOR

RUN AROUND
REDLER CONVEYOR
•



REDLER CONVEYOR ELEVATOR

HORIZONTAL
REDLER CONVEYOR
•



SKIP HOIST

Stephens-Adamson Has THE RIGHT COMBINATION of Conveyors for YOU

Now is the time to review your bulk material handling methods to check such points as these:

Are conveyors of right *capacity* for present volume? Right *type* for the bulk materials now handled? Properly *placed* to move, store and reclaim as needed? Does present system starve or flood processing equipment at any stage? Are the various units in condition to avoid frequent troublesome costly shutdowns?

If questions like these cannot be answered with a clear "yes," call in S-A engineers. Let them make a free survey and give you our recommendations.

There are three good reasons why S-A can help you save time, money and worry on your bulk material handling . . . first, S-A engineers have been solving conveyor problems for nearly 50 years, with a record of thousands of successful installations . . . second, S-A builds all types of conveyors and elevators — and you are assured the right conveyor for each job . . . third, you will find the entire S-A staff helpful and cooperative in every respect.

BUCKET ELEVATOR
•
SUPER-CAPACITY
BUCKET ELEVATOR
•
PIVOTED BUCKET
CONVEYOR-ELEVATOR
•

Write us or phone the nearest S-A branch engineering office.

CRUSHER TYPE
BUCKET ELEVATOR

STEPHENS-ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS · LOS ANGELES, CALIF. • BELLEVILLE, ONT

Designers and Manufacturers of All Types of
BULK MATERIAL HANDLING EQUIPMENT

HAGAN controls

AT ARTLOOM CARPET COMPANY, Inc.

When Artloom Carpet Company, Inc., Philadelphia rug manufacturers, needed increased factory space a few years ago, they decided to eliminate a stand-by boiler room. This was made practicable by modernization and expansion of the regular power plant.

The first step in the program was the purchase of a new boiler and necessary auxiliaries —and the immediate installation of Hagan combustion controls and Hagan Ring Balance instruments on the two old boilers so as to bring up their efficiency. Provision was made at the same time for centralized control of all boilers.

The Ring Balance Steam Flow-Air Flow Meters are of the indicating and recording type. Integrators automatically total steam flow from each boiler. A third pen records stack temperature.

On all three boilers, stokers and fans are turbine driven. Combustion conditions are regulated by direct speed control of stokers and fans. Rated capacity of the old boilers is 50,000 pounds per hour, of the new boiler 65,000 pounds per hour. There are load swings of as much as 30,000 to 35,000 pounds per boiler from the low at night to the peak demand when the dye shift begins work in the morning.

The controls and meters have given complete satisfaction, and have required no attention except routine maintenance since they were placed in operation.

For full information on Hagan Controls and Hagan Ring Balance Flow Meters, call the nearest Hagan representative or write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pennsylvania.

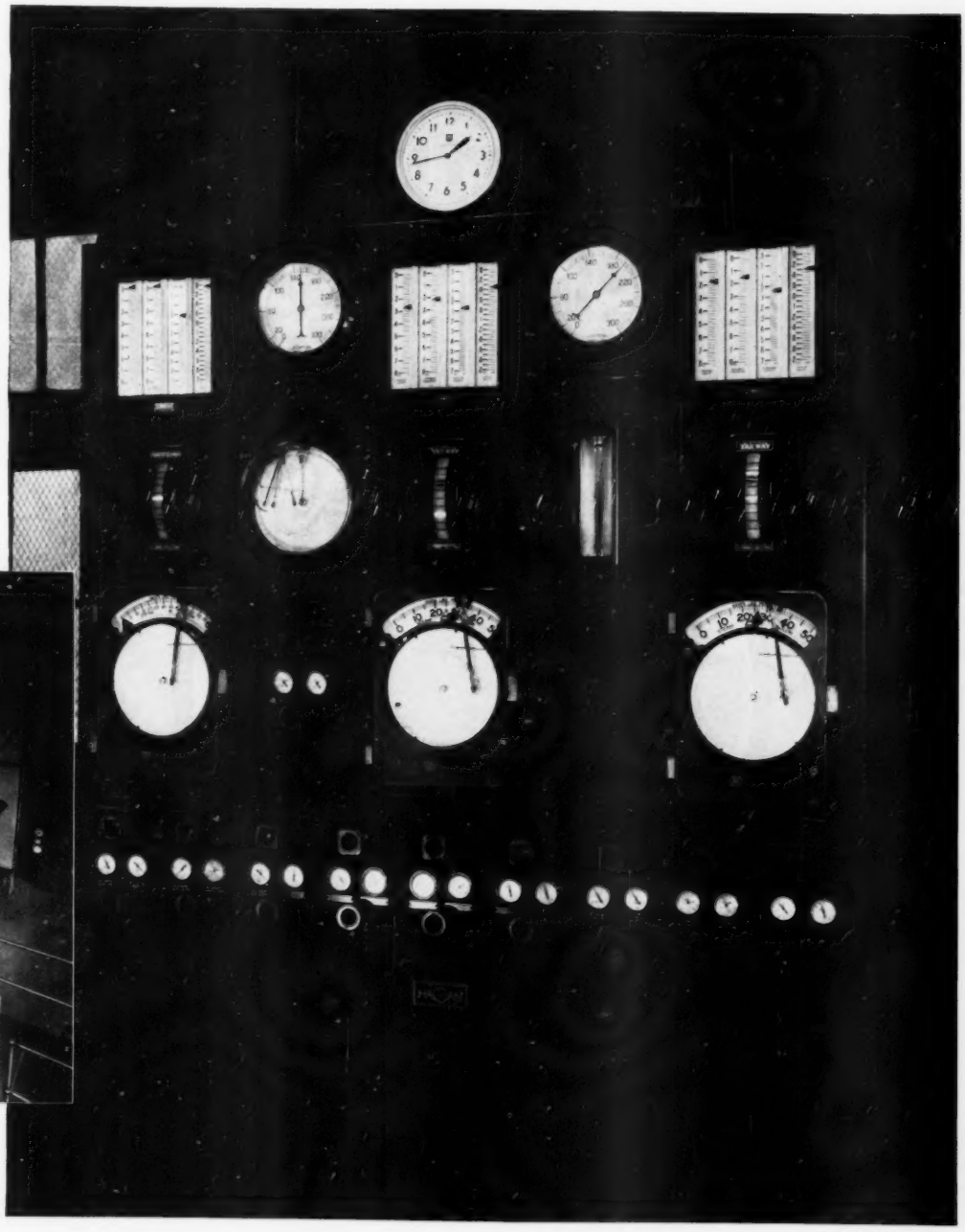
Above: Present boiler room at Artloom Carpet Company, Inc., Philadelphia. Modernization was planned and directed by Louis T. Klauder and Associates, consulting engineers. Otto Helbert, master mechanic, and Arthur Ingram, chief engineer, are in charge of the plant.

HAGAN HALL · BUROMIN CALGON

HAGAN CORPORATION

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCEMEASURING DEVICES

and meters



COCHRANE

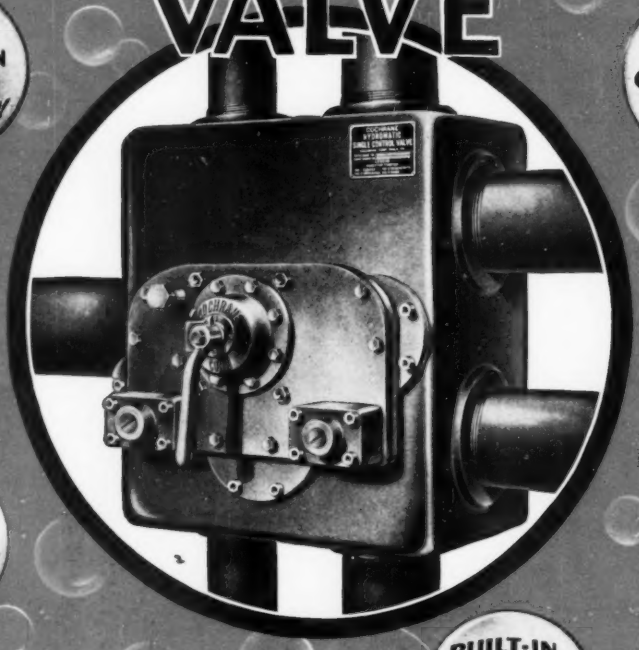
Zeolite Systems & Pressure Filters

featuring the

HYDROMATIC SINGLE CONTROL VALVE

FOUR-POSITION *for* FLEXIBILITY

INTEGRAL RATE CONTROLS *for* COMPACTNESS



PILOT ACTUATED *for* SMOOTH OPERATION

FLEXIBLE BELLOWS VALVE *for* FRICTION FREE OPERATION

TIGHT SEATING *for* RELIABLE SERVICE

SLOW MOTION *for* SHOCK-PROOF OPERATION

BUILT-IN RATE CONTROLLERS *for* WASH AND RINSE

86 YEARS OF SERVICE 1863 · 1949

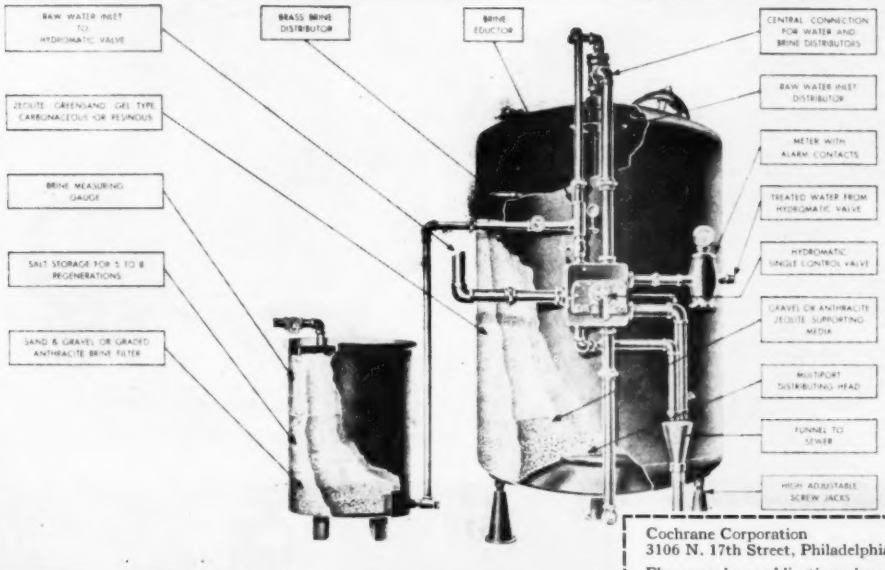
COCHRANE ZEOLITE WATER SOFTENERS INCORPORATE NEW HYDROMATIC SINGLE CONTROL VALVE

THE introduction by the Cochrane Corporation of a remarkable single control valve as standard equipment on its well-known Zeolite Softeners and on its Pressure Filters makes the operation of the ordinary softener and filter system seem far out-moded. This Cochrane Hydromatic Single Control Valve speeds operations and insures accuracy of operation by integrating the functions of the usual valve nest in one single valve with four normal operating positions and two standby positions. All actions of the valve are smooth, positive and free from shock and the single lever turns with ease. Power is provided by the raw water itself through a pilot valve.

May be arranged for manual, semi-automatic or full automatic operation

COCHRANE CORPORATION · 3106 N. 17th Street · PHILADELPHIA 32, PA.

Cochrane Zeolite Water Softener with Hydromatic Single Control Valve

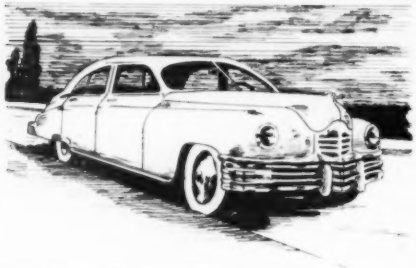

RAW WATER INLET TO HYDROMATIC VALVE
BRASS BRINE DISTRIBUTOR
BRINE EDUCTOR
CENTRAL CONNECTION FOR WATER AND BRINE DISTRIBUTORS
ZEOLITE, GREENSAND, GEL TYPE CARBONACEOUS OR RESINOUS
RAW WATER INLET DISTRIBUTOR
METER WITH ALARM CONTACTS
BRINE MEASURING GAUGE
TREATED WATER FROM HYDROMATIC VALVE
SALT STORAGE FOR 5 TO 8 REGENERATIONS
HYDROMATIC SINGLE CONTROL VALVE
SAND & GRAVEL OR GRADED ANTHRACITE BRINE FILTER
GRAVEL OR ANTHRACITE ZEOLITE SUPPORTING MEDIA
MULTIPORT DISTRIBUTING HEAD
FUNNEL TO SEWER
HIGH ADJUSTABLE SCREW JACKS

Publications describing Cochrane Zeolite Softeners and the new Hydromatic Valve are available. Write for them. Coupon is for your convenience.

Cochrane Corporation
3106 N. 17th Street, Philadelphia 32, Pa.

Please send us publications describing Cochrane Zeolite Softeners and new Hydromatic Valve.

Name_____
Title_____
Firm_____
Address_____
City_____ Zone_____ State_____



1. Is this an au-to-mo-bile?
Yes, this is an au-to-mo-bile.
It is a fine au-to-mo-bile and

POWELL VALVES

helped to make every part of it.

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This automobile merely illustrates the completeness of the Powell Line. The important point is that, no matter what *your* product may be, there are Powell Valves especially adapted for each and every one of your flow control requirements including all services in the field of power.

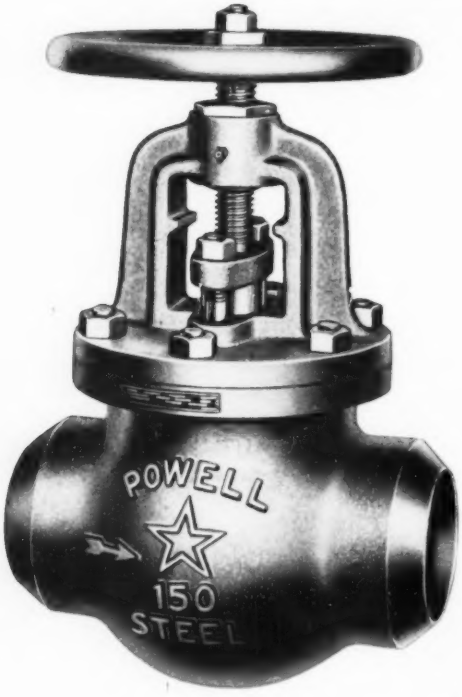

Fig. 1531 W. E.—Class 150-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.

Fig. 11365 W. E.—New Class 1500-pound Cast Steel Horizontal Lift Check Valve with Powell Pressure Sealed Cap, welding ends, and piston-guided disc. Streamline design permits maximum flow through the valve with minimum pressure drop. The Powell Line of Steel Valves also includes Pressure Sealed Globe, Gate, Angle and Non-return Valves.

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Fig. 1303 W. E.—Class 1500-pound Cast Steel Gate Valve with welding ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.

Fig. 1314-A—Class 1500-pound Steel "Y" Valve. Has integral bonnet and welding ends. →

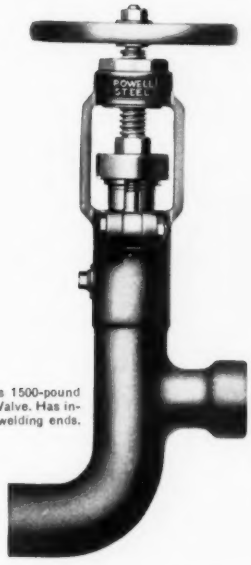

Fig. 1331-A—Class 1500-pound Steel Offset Globe Valve. Has integral bonnet and welding ends.

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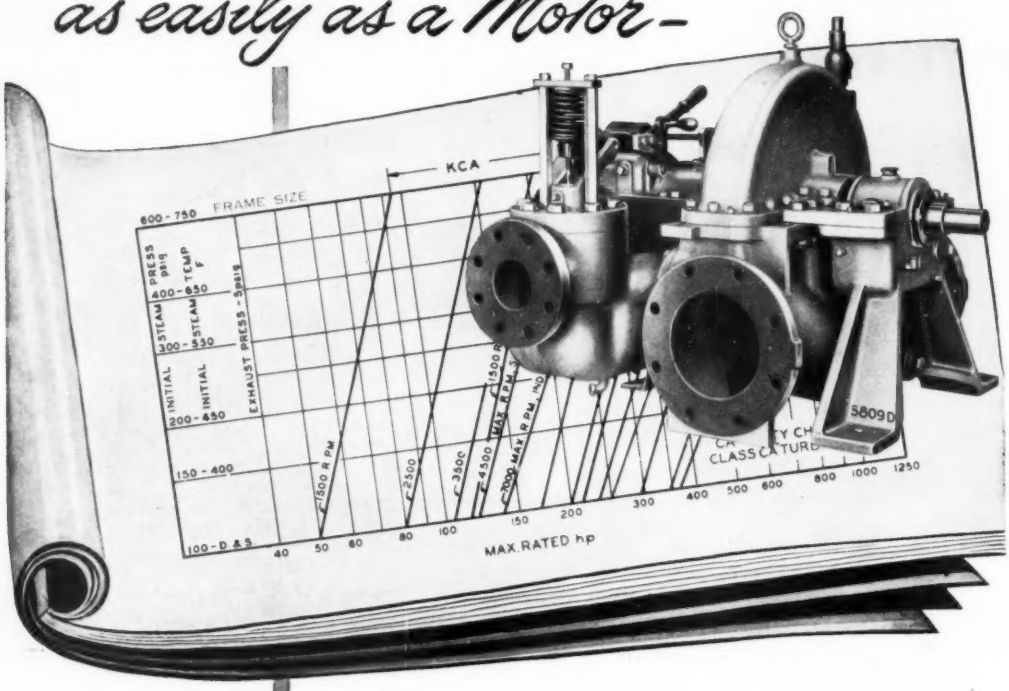

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POWER

FEBRUARY 1949 VOLUME 93, NUMBER 2

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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PUMPS, COMPRESSORS

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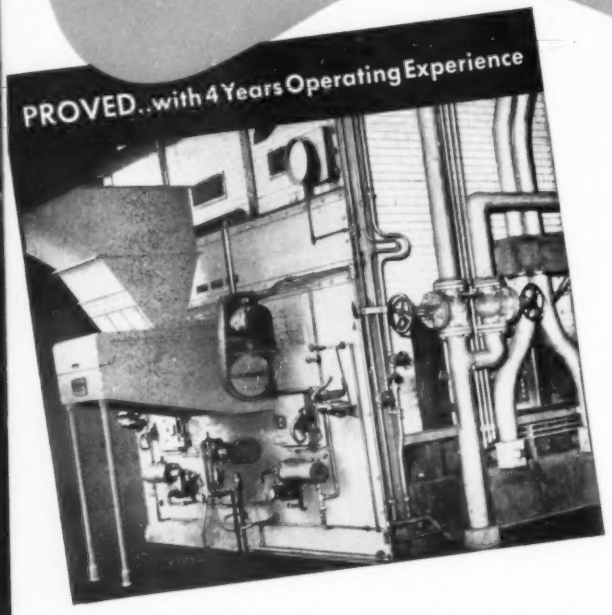

Four years of operating experience at one of America's widely known distilleries (above) has resulted in the design and construction refinements that make Centrafire the *outstanding* spreader-type stoker.

Every point of Centrafire's superiority is proved: high thermal efficiency; maximum fuel combustion; continuous, even coal feed and distribution; economical firing of any grade coal; ash discharged without reducing capacity.

The spreader-type stoker that precisely arranges the elements of combustion for HIGH THERMAL EFFICIENCY and MAXIMUM FUEL COMBUSTION

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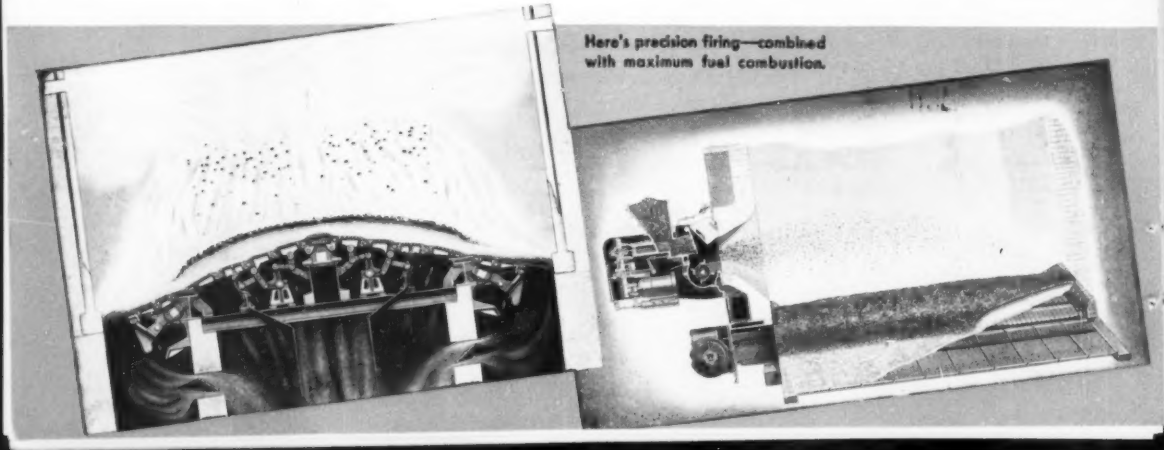
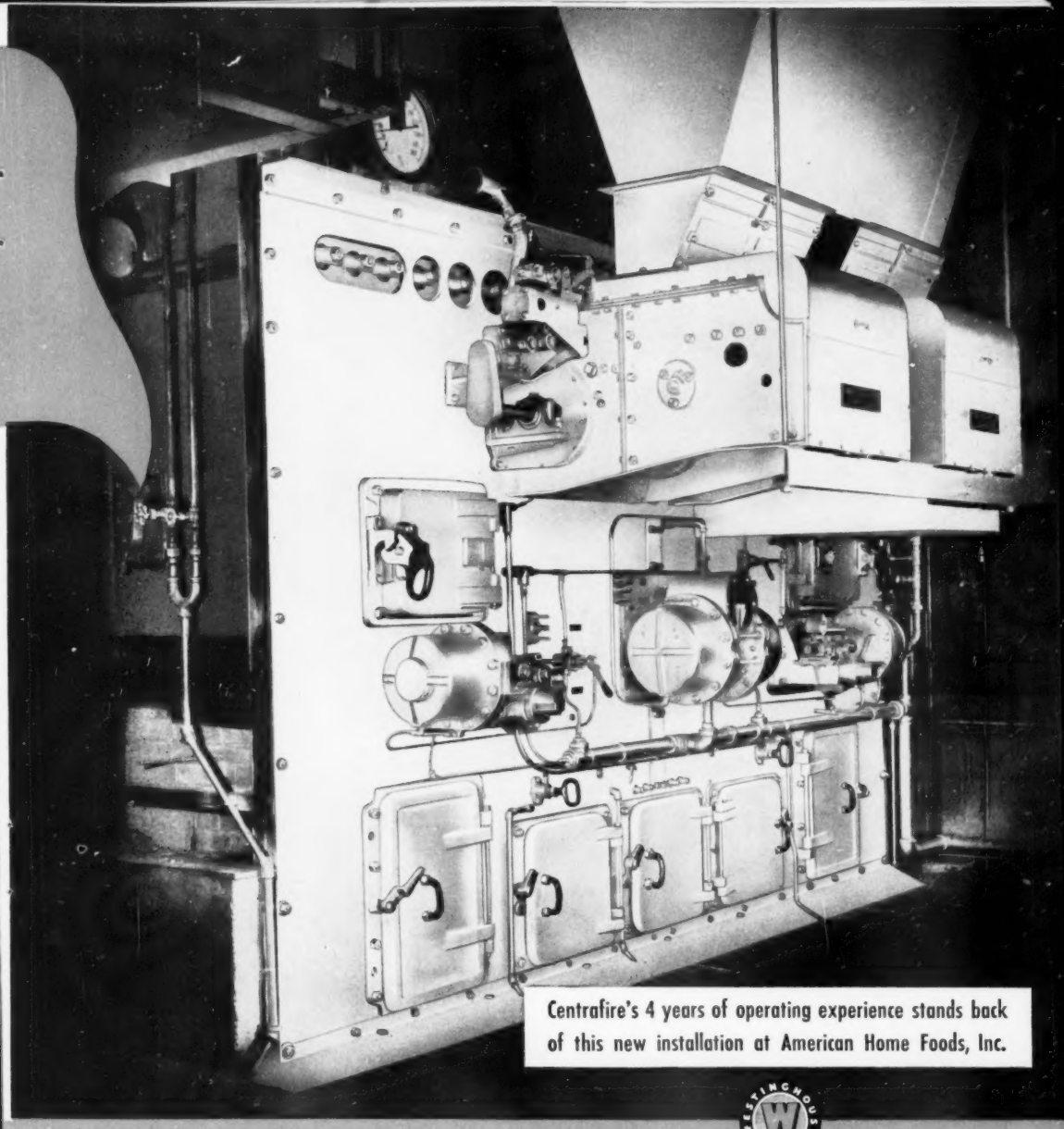
A key feature of Centrafire's exceptional efficiency is the hydraulic drive that automatically maintains preset, fuel-air ratios. What's more, ash is discharged without reducing capacity—since the coal feed is not interrupted and fire is maintained—while ash is discharged at the sides of the furnace.

Centrafire will carry light loads *or* full loads for extended periods . . . or will respond to increased demand from light load to full load without sacrificing efficiency. Get all the facts from your nearest Westinghouse office. Ask for booklet B-3890. Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.



Here's precision firing—combined with maximum fuel combustion.



Centrafire's 4 years of operating experience stands back of this new installation at American Home Foods, Inc.

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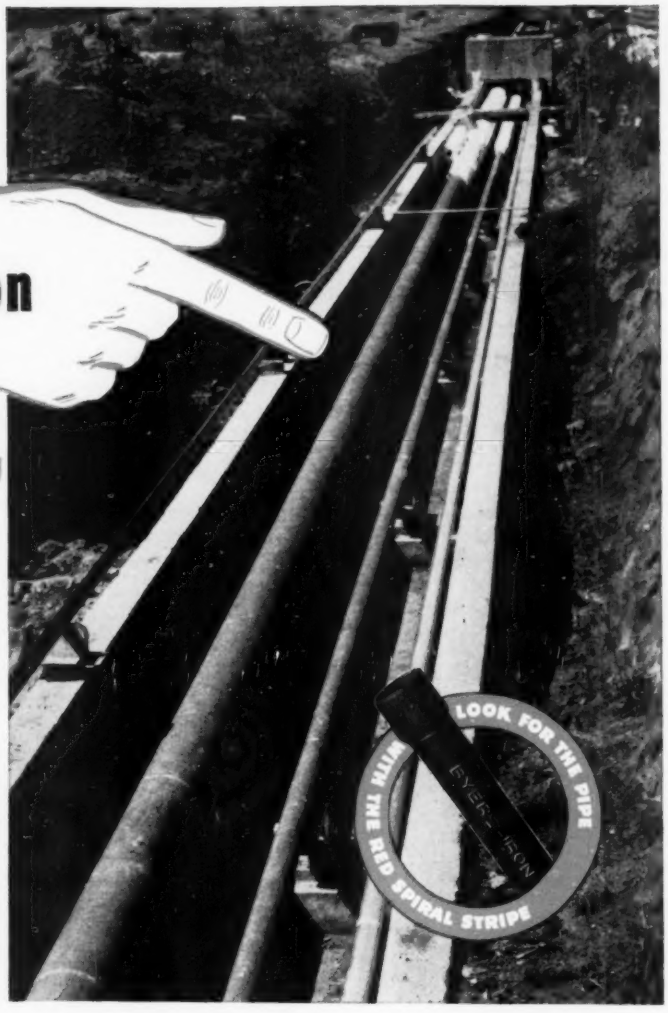

Pipe installed in tunnels faces an extra corrosion threat. Atmospheres are invariably damp at certain seasons. Moisture is alternately condensed upon, and evaporated from, the pipe wall. This means highly aggressive corrosive attack—and the only protection is in the use of a corrosion-resisting material.

In the pipe tunnel recently constructed to serve the new office and testing laboratory shop of the Nebraska State Department of Roads and Irrigation, the lines were safeguarded in a time-proven way, by installing wrought iron pipe. High and low pressure steam lines, return lines and hot water lines were all Byers Wrought Iron pipe, in sizes from 2 to 8-inches. The project was handled by H. S. Seymour, Consulting Engineer; A. W. Bohner, Construction Engineer of the Department; and P. S. Cook Co., Contractors.

The soundness of this selection is indicated by the many unusual service records established by wrought iron. In one typical instance, a 16-inch wrought iron line was installed, then relocated after 13 years of use. All pipe was found in first-class condition with the exception of one length. Analysis revealed that this failed length was NOT wrought iron. It was replaced, the rest of the original pipe re-installed, and the engineers report that after 29 years of service, no further maintenance had been required.

There is no secret as to why Byers Wrought Iron pipe serves so well—it is the result of the unique composition and structure of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and "detour" corrosive attack, and discourage pitting. The fibers also anchor the initial protective scale, which shields the underlying metal.

You will find a comprehensive review of the problems in underground services—and their successful solution—in our bulletin, "Wrought Iron for Underground Services". Ask for a copy.

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POWER

PHILIP W SWAIN, EDITOR • FEBRUARY • 1949 • ESTABLISHED IN 1882

Big Savings in Small Plants

TAKEN ONE BY ONE, the "pint-sized" steam units of countless small laundries, hotels, public buildings, corner-lot factories and similar establishments may not seem important except to their operators. Yet these plants, as a group, demand attention because they burn sixty million tons of coal per year—ten percent of all coal mined and more than half the total consumption of utility steam plants.

And note that this figure does not include the medium- and large-sized industrial and institutional plants generating more than 5000 lb per hour.

The annual coal bill of these countless "two-by-four" plants totals hundreds of millions of dollars. The fuel-dollar waste alone, from poor coal selection and bad burning, probably tops a hundred million.

Add to this the wages wasted in shoveling—also pushing wheelbarrows at today's wage rates—and the big intangible losses from dust and dirt in the basement, and smoke and dust above ground.

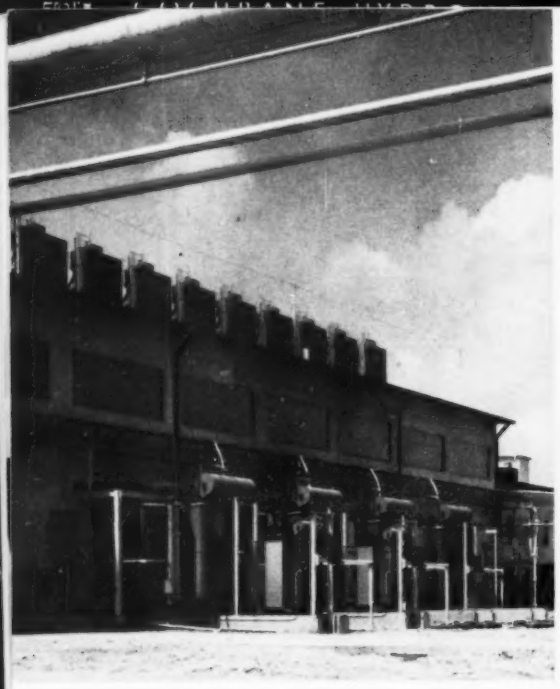
Who is to blame? Not the equipment manufacturers! It's not their fault that the very small plant is the neglected stepchild of the power field. They have always urged their small-plant prospects to go modern, but it's no easy task to convert penny-wise managers. Many of these hope to get rich by never buying anything—except too much fuel, too much labor, and too many repairs.

One thing the average small-plant operator needs is a "big brother" to give him practical engineering advice, and help him show his own management the true art of saving power dollars.

Right here is where the typical POWER reader comes in. He is one of the top power men in a larger plant in the same town. The small-plant operator is his friend—often talks with him at local engineering and fraternal meetings.

So advice and help will naturally flow from the typical POWER reader to the small-plant operator. And very often this reader can directly serve the management of the small establishment because his standing as an engineer is recognized by the entire community.

So if your own boilers generate more than 5000 lb per hour you can still use the facts presented in the special section that starts on page 91. There you will see how the little plant can mechanize firing and handling, get rid of the shovel and the hoe, seal in the dust and dirt, reduce the smoke, cut labor costs without cutting wages, boost efficiency, and give the operator a bit of professional status.



1 Note overhead rack carrying cables to indoor rectifiers from main transformers. Rectifier heat exchangers on roof

2 Process piping and power-distribution armored cables are carried outdoors on the same overhead H-frame structure

Texas Plant Generates and Rectifies

Electrical energy must be available on a 24-hour 7-day week schedule to handle production of chlorine and caustic soda in new Pasadena plant of Diamond Alkali Co. Ignitrons take 80% of 30,000 kw generated to supply the electrolytic cells

By J R HORACEK, *Utilities Engineer*
Houston Works, Diamond Alkali Co, Pasadena, Texas

►WHILE ELECTRICAL POWER can be bought at reasonable cost from a local public utility, we deemed it best to generate our own power, to keep close tab on varied process requirements. Hence the electrical system is self-contained, depending entirely on our own equipment for power generation and distribution.

Economics. Amount of power needed to operate any given electrolytic cell, to produce chlorine and caustic soda from raw salt brine, is more or less fixed. In a chlorine-caustic soda plant such as ours, a large part of the generated power (approximately 80% in our case) is used for electrolytic decomposition of the brine. Once the daily tonnage is determined—220 tons of chlorine and 240 tons of caustic soda—it becomes a relatively simple matter to fix the power requirements at about 30,000 kw. The problem then resolves itself into determining number and sizes of the various generating units and standby equipment needed to assure continuity of service.

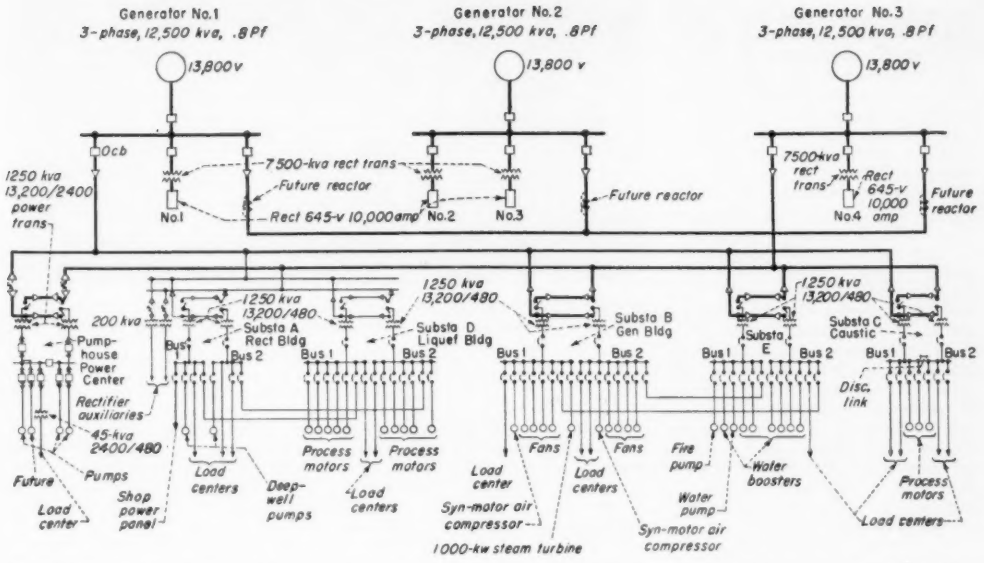
A careful study was made of the electrical and steam loads, effect of electrical outages on production and cost of securing a flexible power supply through installation of two or more generating units, together with their auxiliary equipment. Results showed three 10,000-kw generators would best suit our load requirements.

Investment involved in standby units and output losses attributed to out-of-service time for equipment maintenance and repairs showed standby equipment was not necessary.

On the basis of these findings, we set out to design a generating plant and power-distribution system which, because of the type of load served, would not only be dependable, but would also prove capable of operating with a base plant load about equal to the total generating capacity provided.

Generator Details. Each of the three generators is a 2-pole machine rated at 10,000 kw, .8 pf, 13,800 v. Units are air cooled with air-to-water heat exchangers. It was considered unnecessary to use hydrogen cooling with our relatively small units delivering a constant load.

Both main and pilot exciters are coupled directly to each generator shaft. Generator field bridge-type rheostat is motor operated from main control board. Pilot-exciter rheostat, used as a variable series resistor in the pilot-exciter field, is similarly controlled.



3 Single-line diagram shows electrical power distribution. General plan is to transmit power at 13,800 v to various plant load centers (substations) where it is reduced to 460 v. Note double feed to each substation with selector disconnects

Own Power for Electrolysis of Brine

Motor-operated voltage regulator on each generator varies the main exciter field. Its contacts close intermittently to operate the main exciter rheostat. Auxiliary high-speed contacts are provided, which automatically insert resistance on a sudden rise in voltage, or short out part of the main rheostat on a sudden drop in voltage. Rheostat may be operated by hand should the control circuit fail.

Generator and Feeder Protection. Generators are protected by differential relaying, which overlaps the bus differential protection. Generator relays open the generator main breaker, generator field and the neutral breaker. Generators are also equipped with overload and reverse-power relays. Overload relays are set high and serve principally as back-up protection.

Generator neutral is grounded through a resistor that limits ground fault current to 500 amp. High-speed ground relays protect all high-voltage cables to isolate a grounded cable.

A ground bus network has been provided throughout the plant. Every piece of switchgear, cable support, building steel, motor frames, etc., is connected to the same ground as the generator neutral resistor. This ground network is considered essential to minimize shock hazards to operating men, prevent electrolysis of cables because of stray currents, and provide the most dependable type of protective relaying.

The three sections of high-voltage switchgear are connected together through a synchronous tie bus, which connects to main busses through oil circuit breakers mounted in each bus section. Differential relays protect this tie bus and overlap relays on main busses.

Switchgear. Outside the generating plant there are three sections of switchgear, one for each generator. Switchgear consists of outdoor metalclad busing with draw-out ocb's. Each unit, rated at 15 kv and 600 amp, is installed over a tunnel that allows cable to enter the gear from below. Automatic protection prevents the drawing out of a live breaker. Switchgear is equipped with bus differential relaying, which operates to open all breakers connected to bus in case of a short circuit within switchgear.

Primary Cables. All high-voltage cables throughout the plant, including generator leads, are insulated with varnished cambric and covered with a vinyl hose jacket. Cable is protected with interlocking bronze armor covering. Generator leads drop into a cable duct connecting with tunnels beneath switchgear units. These single conductor cable leads are racked on tunnel walls. Transite baffles over each set of leads protect them against damage from short circuit. Wood and aluminum are used in support construction to prevent cable absorbing heat from iron supports. A blower mounted at one end of tunnel handles cooling.

Overhead Distribution Cables. Many chemical plants, especially those having electrolytic operations, find soil conditions and cable electrolysis make use of underground lead cable impracticable. Corrosion caused by chemically saturated soil and cable failures traced to electrolytic action of dc leakage are frequently encountered. Even without these drawbacks, since the process piping was to be carried on an overhead structure, it was no problem to utilize the same structural network to support the power cables.

Process pipes are supported on modi-

fied H-frames, the tops crossed with supporting beams. Box trusses are fastened to the overhanging sections of each beam and then extended from frame to frame. Metal grating is placed on both top and bottom of box trusses. Armored cable, laid on the grating, is held in place with wood blocks and J-bolts, Fig. 2.

Mercury-Arc Rectifiers. Since dc is required for electrolytic cell operation, most of the power generated is converted through four 650-v mercury-arc rectifiers, each rated at 10,000 amp. Rectifier main transformers are rated at 7500 kva, with 13,800-v primaries and 612-v line to neutral secondaries. Transformer secondaries are connected double 6-phase with interphase transformers between neutrals. Two of the transformers are connected wye-wye, and two delta-wye. To eliminate interference with telephone circuits and prevent generator heating from harmonics, the complete rectifier installation is designed for 24-phase operation with the four rectifiers operating.

Each rectifier transformer is connected with copper channel bus through a set of 12 disconnects to the line side of anode breakers. The anode circuit breakers serve to disconnect rectifier tank from line in case of arc-back. These breakers are equipped with polarized holding and trip coils, which interrupt reverse current (arc-back current) in one-half cycle.

Rectifiers are water-cooled 12-tank metal ignitrons, equipped with vacuum-maintaining equipment. They are installed on the second floor of the building, with all cables and busses mounted beneath the second floor and brought up through slots to each unit.

Alternating current enters through anodes at top of each rectifier tank. The arc inside each tank transmits the rectified current to mercury pool cathode on tank bottom. Rectifier frame is not insulated from cathode; hence unit is mounted on insulators. All cooling water to rectifier flows through rubber hose at least 30 ft long. All auxiliary electrical devices on the frame are fed by insulating transformers.

Rectifier cathodes are connected by a copper bus to cathode breakers, which open the circuit in case of short circuit in the electrolytic cells. Each rectifier connects through a tie breaker to a tie bus on floor below. A single rectifier normally feeds one electrolytic cell circuit. In emergency the ties may be closed, letting one rectifier serve more than a single-cell circuit.

Negative leads run from the main transformer neutral into the auxiliary-room negative bus. Isolating disconnects are located in negative side between bus and electrolytic cells. Negative tie bus and negative main bus can be connected through isolating disconnects.

4 Row of mercury-arc ignitron rectifiers for the conversion of ac to dc. Units located on second floor of Rectifier Bldg are rated for 10,000 amp at 650 v

Water-to-air heat exchangers, placed on the roof, are cooled by nine propeller-type fans, which may be switched on or off in groups of three. Since heat exchanger frames are above ground potential, because of voltage leaking through rectifier cooling water, they are mounted on insulators and the electrical control is supplied by insulating transformers. Heat exchangers are mounted to take advantage of prevailing south wind, aiding the fans.

Rectifier vacuum-maintaining equipment consists of a high-vacuum mercury jet pump, which exhausts the ignitron tanks into a rotary oil-sealed roughing pump. The rotary vacuum pump then exhausts to atmosphere.

Rectifier Reconditioning. Between the year rectifiers were built and the time they arrived at our plant, the manufacturer had made a number of improvements to decrease their backfire rate. To place the rectifier tanks in working order, each one was completely dismantled on arrival and the new and improved replacement parts installed. All internal parts were cleaned and the mercury renewed. Tanks were then reassembled and sealed. All auxiliaries were dismantled and reconditioned. Since tanks had been opened to the atmosphere the rectifiers required a complete bake-out. This was handled by passing a high current through them at low voltage. The baking-out released gases the metal had absorbed. These gases were then removed by the vacuum pumps. Success of this reconditioning process—first time that a job of this size had been attempted at point of use—is evidenced by the low arc-back rate now being obtained.

Rectifier Protection. Rectifier transformers and their feeders are protected by overload and ground-current relays. Transformer cases are grounded through a current transformer, which operates a relay to trip the high-voltage feeder breaker in event of an internal transformer fault.

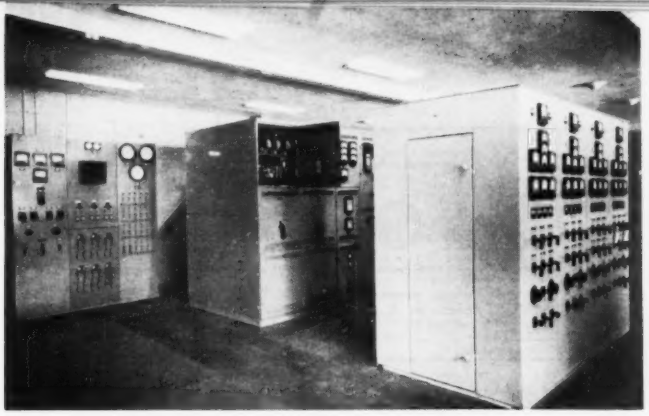
Arc-back (or back-fire) phenomenon is an inherent characteristic of mercury-arc rectifiers. Arc-back is caused by the failure of a rectifier to stop current flow during the negative half-cycle, which is essentially a short circuit on the arc side of the rectifier. This short circuit is cleared by reverse-current relay operation.

Rectifiers were originally set up so both anode and cathode breakers of a faulted unit would open on arc-back. This would take the complete rectifier off the line. We removed the reverse current protection from the cathode breaker and increased its overload relay setting so the anode breaker would clear the arc completely before the cathode breaker operated. Anode breakers were connected so only the pole on the faulted tank would open. This could be closed without disturbing the remaining poles on the breaker. Hence load can be maintained during arc-back and breaker immediately reclosed without affecting electrolytic-cell operation.

Rectifier, main transformer and mercury vacuum pump are protected against over-temperature. In addition to other protective features the rectifier gives alarm on low water and loss of vacuum.

Control Room. Any operating change in the rectifiers will affect the generators and vice versa. If generator and rectifier control points were separated, close communication would be necessary between the two points and, in emergency, confusion would probably result.

To avoid such difficulties, we brought generator, feeder and rectifier controls



5 Control room, adjacent to rectifier room, handles generators and rectifiers. The boards have switches and instruments on front, relays and meters on rear

into one control room. With boiler operators available at the power house to check turbine-generator operations, we located the combined control room adjacent to the rectifier room where engineers are always on hand to check rectifier operation.

In control room, adjacent to second-floor rectifier room, rectifier and generator control boards face each other, Fig. 5, making it convenient for the dispatcher to operate between them. Instruments keep him advised at all times on the condition of his units. Control boards are tunnel type, with switches and instruments mounted on front, and relays and meters on rear.

Control Wiring. All control wiring is done with multiple conductor, color-coded, vinyl-insulated cable. Rectifier-control cables drop inside the control board through floor slots into transite cable trays on ceiling of floor below.

At each rectifier, cables for that unit and its auxiliaries are transferred to smaller cross trays, which take each cable to the equipment it controls. All instrumentation, control and metering are handled at the control board. Control cable for generators and feeders are run about the same as for rectifiers.

Power, voltage, frequency, current and temperature of the generators are indicated on the generator control board. Protective relays are mounted on the same board. Control of breakers, voltage, frequency and load is handled from this point as well. By observing his control board, control-room operator can tell at all times the operating condition of machinery in his charge.

Secondary Distribution. Since the various plant departments are interconnected process-wise, secondary power must be made available to avoid stopping all operations when a power failure interrupts one. The general scheme is to transmit power at 13,800 v to various plant load centers where it is reduced to 440 v. Substations are located at water-intake station, main control room, power house, caustic evaporation area, chlorine liquefaction installation and at water booster-pumping station.

Two feeders, controlled by ocb's, supply power to substations. Armored cable from each breaker leaves switchgear and runs to two 13,800-v junction boxes. Branch feeders from these junction boxes supply power to four substations directly and also to two junction boxes at control room. These are set up for feeders to future stations and to supply power to substations in control room and liquefaction area.

Individual substations have two circuits, each served by a 1250 kva. 13,800/440-v noninflammable, liquid-cooled transformer and a 440-v air circuit breaker. Selector-type disconnects are mounted on transformer primaries to prevent putting six transformers out of service should any feeder cable short circuit. These disconnects allow transformer to be energized from either feeder. Transformer power feeds through secondary breakers to metal-enclosed switchgear. Substation and rectifier feeders are carried on pipe support trusses and building wall.

Distance to water-intake station from plant is about 3500 ft with no supporting structures available. Hence interlocked armored cable with a built-in messenger is used. This cable is hung from 30-ft class-3 creosoted poles spaced at 150-ft intervals. Messenger is grounded at each pole and at intake piling. Plant end of messenger is grounded to the plant ground network and to 60-ft metal pile driven at power house.

Flexibility. To insure service continuity, it was originally planned to interconnect all 440-v substation busses through suitable breakers. This system, however, required breakers of an excessively high interrupting capacity.

To lower required interrupting capacity without greatly affecting continuous service, busses were interconnected in pairs, with other busses in different substations. This arrangement increased tie reactance and brought required interrupting capacity to desired level without sacrificing service continuity.

With this system each bus in the Liquefaction Building substation is connected through breakers to a bus in the control-room substation, Fig. 3. Similarly, the power plant is connected to the booster station on the 440-v side. Reverse-current relays are provided on the transformer secondary breakers.

With relays set correctly and selector switches in the proper position, a fault on either feeder is cleared by overload operation on the high-voltage breaker and reverse-current operation on the transformer secondary breakers. This clears the faulted feeder and requires no deenergizing of a substation bus.

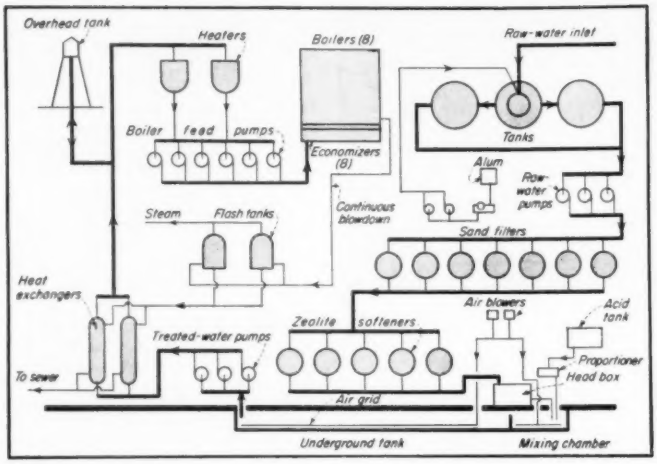
Motor Control. The transformer secondary breakers are rated at 1200 amp (75,000-amp interrupting capacity) and the 440-v tie breakers at 600 amp (50,000 ic). Air circuit breakers of the same ic as the tie breakers are used to start motors of 60 hp and above. Smaller motors are started by combination circuit-breaker starters, mounted in control centers supplied by breakers in the high-capacity gear. All motors are across-the-line start, including the 230-v 30-hp intake-station motors. The 2300-v gear is the airbreak type. System is designed to hold voltage drop on the starting of any motor to less than 5%.

Lighting transformer banks are located near load concentrations and range from 30 to 225 kva. Banks are served from either the high-capacity gear or control centers, depending on lighting transformer size and service. These transformers are connected delta on the 440-v side, and grounded wye on the 208/120-v side.

Generator Starting. Before boilers could develop rated steam pressure, it was necessary to operate electrically driven auxiliaries. Also, the turbine condensers had to be supplied with cooling water before bringing the generators up to speed. Each cooling-water pump was 300 hp. The boiler induced-draft fan was 200 hp, and the forced-draft fan 100 hp. Load requirements of various other auxiliaries totaled about 50 hp. Fan motors operated on 440 v, the cooling-water pumps on 2300 v.

Of course, since no electrical energy was available from main generators,

(*Continued on page* 174)



1 First treating plant at Stanolind Station No. 1 consisted of greensand zeolite softeners protected by pressure sand filters and alum mixing-and-settling tanks

Pioneers in Feedwater Treatment

Before the turn of the century when power men learned water conditioning the hard way, Whiting engineers began to find the answers by eliminating guesswork from treatment proposals

By GLENN R HULL

General Foreman, Utilities & Conservation Div, Whiting Refinery
Standard Oil Company of Indiana

► IF YOU WOULD ENJOY a chat about boiler feedwater preparation, let's knock off for a few minutes to discuss treatment at the Whiting Refinery of the Standard Oil Co (Indiana). The refinery is near the southern tip of Lake Michigan, from which the plant gets its raw water.

"Back When." Our historical data were collected mostly from men who have been retired some years, for this story starts roughly a decade before mothers named their babies Dewey for the hero of Manila Bay. The original boiler crews were mostly Irishmen—a hardy lot, afraid of nothing, who gravitated naturally to the "bylers." Representative of this group was Andrew J Harmon, who became an assistant superintendent in the steam department. He is now retired.

Not only did Andy furnish a great deal of background for this story, he was also helpful and tolerant during the period when the writer was cutting his power-house teeth. In paying tribute to him, we are paying tribute to all the granddaddies of modern water conditioning. Twenty years ago, most water treatments used by the oldtimers were smile provoking, and some still are today. But in the light of today's findings, certain of their treatments were really beneficial.

Good for Everything. Then, as today, high-pressure salesmen sounded off about cure-alls that were good for nothing except the pocketbooks of the vendors. On the other hand, many sound treatments were available. From the evidence it appears that in those days considerable rugged individualism was expressed about feedwater preparation —to wit, the dead-cat treatment.

We, in the steam and power departments of industry, feel slightly as if salt were being poured on an open wound when manufacturing or processing is discussed without including the production of steam and electrical energy. Here is a chance for a small measure of retaliation.

Steam Comes First. First production at Whiting Refinery was steam. First operating units put into service were boilers to furnish steam for the machine shop and produce compressed air for construction. From that time on, as the plant expanded, additional boilers were placed in operation—always near the spot where the steam was to be used. These early boilers were all hrt units operating at about 80 psig, saturated steam. By the time the first watertube units were put in operation, about one hundred hrt boilers had been installed.

Original water treatment at the refinery was based on experience gained at Cleveland, Ohio in Standard Oil Plant No. 1. Consequently, most of the fads in vogue at many of the old-time boiler houses were not sanctioned at Whiting. From the start of the first boiler, soda ash was used. It was fed into the boiler-feed-pump suction. If such unorthodox treatments as the use of dead cats, potato peelings, sawdust or refuse from horse barns were tried, all memory of these experiments has been lost. Since good old sour Lima crude oil was handy, a bucket of that, put into the boiler at starting-time, was considered quite the thing for a while.

Graphite Not So Good. Memory fails to tell us the extent of visits made by treatment salesmen but one vendor and his product are not forgotten. This gentleman high-pressured the boiler people into trying his "pure chemical," which was graphite. Luckily it was tried in only a few boilers. Another old-time product called "Perolin" was tried in the low-pressure boilers and found satisfactory, except that it cost too much. Thus, during the first phase of boiler-water treatment at Whiting Refinery, soda ash did the trick. As soon as the first oil was processed, the practice of picking up refinery waste heat in the raw water was started.

Second phase of boiler construction and operation came at about the start of World War I. This step saw the concentration of boilers in larger buildings, the installation of watertube units, the use of boiler steam flowmeters, more direct and specialized boiler-plant supervision, and the periodic use of the re-

finery laboratory for testing boiler water. A prepared internal treatment called "Modoc" was fed to all these boilers. It was a satisfactory treatment consisting of soda ash, phosphate and tannin. These boilers produced about 90-psig saturated steam.

Byproduct Power. Third phase of steam production started in 1928. Main feature of this step was the concentration of all steam generation for the refinery into a single power station where electrical energy, used in the plant, was generated as byproduct power with 400-psig turbine-generators exhausting at 100 psig, and 100-psig machines exhausting at 10 psig. Desuperheater and reducing valves made the system flexible.

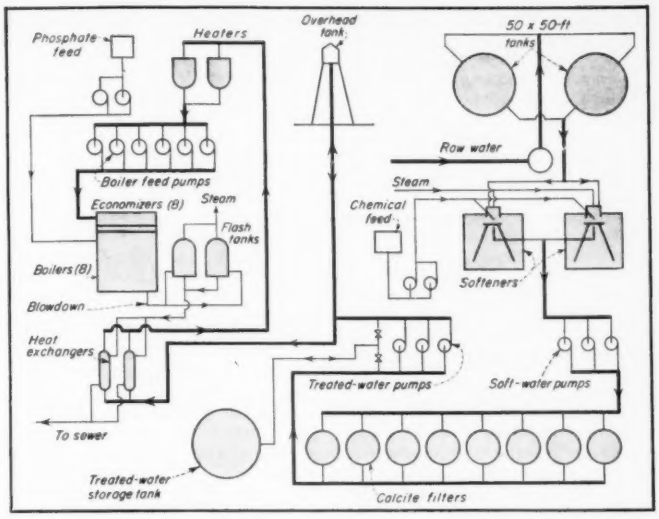
This plant, known as Stanolind Power Station No. 1, contains eight Stirling type B&W boilers. They produce about 175,000 lb per hr each. Header pressure is 400 psig, and total steam temperature is 650 F. In 1943, a second boiler plant, Stanolind Station No. 2, went into service with five boilers and no electrical-generating equipment. These are 200,000-lb-per-hr 400-psig 650-F total-steam-temperature Foster-Wheeler type A units.

First Zeolite. Original water treatment at Station No. 1 was a natural greensand zeolite system. Fig. 1, operated as follows: There were three 30x30-ft raw-water tanks. Lake Michigan water, which had been heated with waste heat in the refinery to 90-120 F, entered at the top of the center tank. Filter alum solution was added, the mixture flowing down through a cylindrical baffle to a point close to the bottom of the tank. The water then flowed up to two outlets near the top and over to the two remaining raw-water settling tanks, which were connected in parallel to the raw-water pumps.

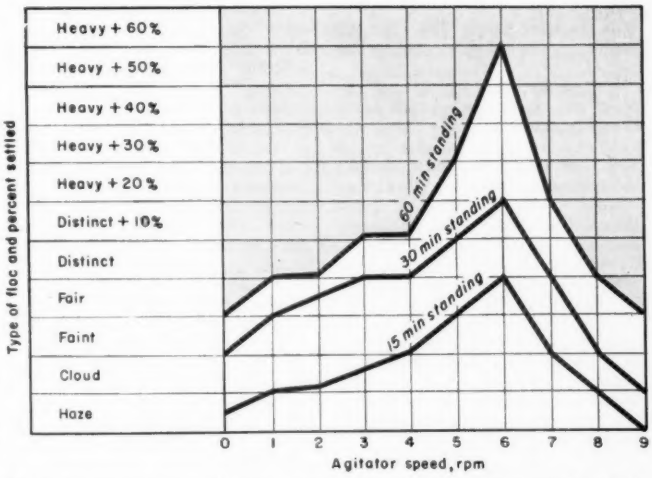
From these pumps, the water went through seven horizontal pressure-sand filters and five horizontal zeolite softeners. The softener effluent went through a head-box type sulphuric-acid proportioner and into an open rectangular tank in which air from a grid on the bottom of the tank mixed the acid with water and dispelled the freed carbon dioxide. Treated-water pumps took suction from the open tank, their discharge going into two deaerating heaters. From here, the water went through economizers to the boilers.

Economizer Corrosion. Within a few months, severe corrosion was found on the water side of the economizer tubes. Corrosion test strips were used as guides in the study of this difficulty. The dissolved-oxygen content of the deaerated water was 0.10 to 0.15 cc per liter, while the pH was 7.1. Enough boiler blowdown was circulated to the suction of the treated-water pumps to bring the pH to 9.0 with practically no improvement in corrosion rate. The heaters were revamped internally so they delivered water with zero oxygen by the Winkler test. The circulated blowdown was discontinued, returning the pH value to 7.1. Water-side economizer-tube corrosion dropped to a point where it was no longer a problem.

Baptism With Mud. After about a year's operation of the zeolite beds, an extended storm period muddied Lake Michigan so much that uninterrupted backwashing of the sand filters did not properly reduce the load on them. Consequently, high head loss and breakthrough resulted in turbid water entering the zeolite beds, coating the particles and quickly reducing the softening capacity. As a last resort, a small amount of raw water was bypassed around the softeners to maintain steam capacity. In about a day, all boilers



2 Algae problem was licked by installing a chlorine feeder and agitator tank ahead of 50x50-ft settling tanks. Rough settler tanks were not very effective



3 Water samples, removed from mixing tank at different agitator speeds and allowed to stand 15, 30 and 60 minutes, showed how to obtain best floc conditions

had leaks. When the storms subsided, the filters and softeners were dumped, their material hand washed, regraded and recharged into the tanks. The zeolite lost capacity, which was not restored, even though reconditioning was tried. Treatment consisted of washing with caustic soda and with varying amounts of caustic soda and sodium silicate.

Following the baptism with mud, came the gray plague. Great gobs of gray, slimy material appeared in the raw-water tanks. It worked its way through the filters, finally getting into the softener beds and causing a further reduction in softening capacity. Several laboratories, all working from the chemical angle, failed to identify it. It is putting it mildly to say the station personnel were sweating bullets.

Chlorine Does the Trick. A sample of the material was accidentally exposed to sunlight. Then came a revelation. The blamed stuff turned a brilliant green. It was alive! Chlorination of the raw inlet water, at first experimentally and later on a commercial basis, solved the problem. To today's water doctors, the above algae problem is in the kindergarten class. But that wasn't true when our problem appeared.

While chlorination experiments were being run, the raw-water-tank equipment was rearranged as in Fig. 2. Raw water was fed to the top of a 15x15-ft tank, the top third of which contained a variable-speed agitator. Filter alum solution was introduced at the top of the agitator, where a splash plate mixed the water and alum prior to agitation. Chlorine from a Wallace & Tiernan chlorinator was introduced just below the agitator. Leaving the first tank, the water went in parallel through two cylindrical tanks tilted about 10 deg from horizontal. These tanks were called rough settlers; incidentally, they were never very effective. From these tanks the water flowed through two 50x50-ft round tanks in parallel.

The water then went through the three original 30x30-ft tanks in series to the raw-water pumps. All tanks were equipped with desludging devices while the 50x50-ft tanks had oil skimmers also. The revamped raw-water system was effective as pretreatment equipment for zeolite softening. At this time, an additional filter and softener were installed. To find both the effect of agitation on alum-floc quality and the optimum speed at which to operate the agitator, samples of agitator effluent, taken at various agitator speeds, were allowed to stand in large beakers for one hour. An estimate of the floc condition and the percent of floc settled in the beakers was made for each sample after 15, 30 and 60 min. Results are shown in the graph, Fig. 3.

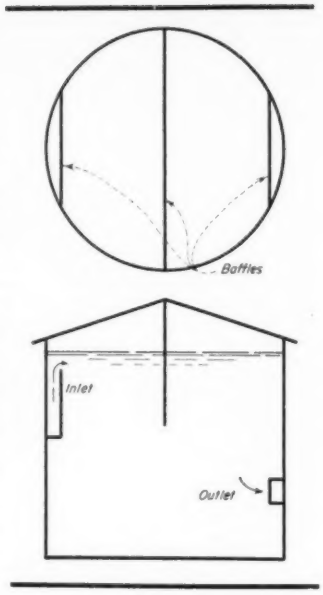
Dye Tracer. Tests using water-soluble dye indicated serious short circuiting of the water going through the 50x50-ft tanks, thus rendering them ineffective in actual retention time. Consequently, laboratory tests were made using glass tanks with various types of baffles. Flow rates were scaled down to duplicate operating-tank flow. Water flow through the glass tanks was studied by using the dye. Tests indicated that a baffle arrangement, Fig. 4, was quite effective. Accordingly, this type of baffling was installed in the 50x50-ft tanks with the result that, instead of the dye appearing in the tank outlet in 10 min and clearing the tank in about 30, as it did originally, it did not appear in the tank effluent until about 4½ hr after being introduced into the inlet. Also, the dye persisted in the tank outlet for about 7 hr.

Too Hot for Zeolite. Partial softening by pretreatment with chemicals ahead of the zeolite beds was studied. A lowering of treatment costs and an increase in softener capacity was indicated. Such a treatment was not tried, however, because water too hot to use on zeolite became available from the refinery.

Aside from the fact that zeolite capacities are sensitive to contamination of the particles, temperature of water that can be safely used with natural greensand zeolite is limited. To realize the saving effected by using hotter water, a hot lime-soda internal phosphate treating system, Fig. 5, was installed.

The softeners were made from the 30x30-ft raw-water tanks. Conventional conical-skirt baffles were used, the sludge blowoff being accomplished in the flat-bottom tanks by spiders. Phosphate was fed directly to the boilers. Naturally, a new crop of headaches developed. One was our old friend, short circuiting — this time through the softeners. Retention and mixing of chemicals with the raw water was improved by changing the plates above the baffles from a flat horizontal design, as in Fig. 5, to a saucer-shaped arrangement.

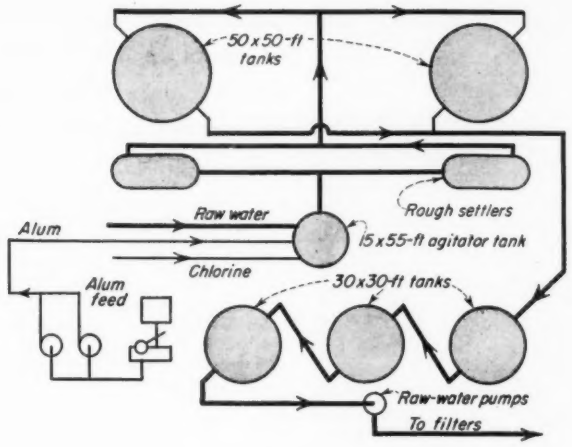
Phosphate Feed. To render the softeners' residual hardness nonscale-forming, phosphate solution is pumped through headers and risers that conduct the solution to individual boilers. Each riser has an indicating orifice-type flowmeter, graduated in thousands of pounds of steam per hour. Proportioning of phosphate solution to each boiler is controlled by hand adjustment so indications on the solution meter correspond to those on the boiler-steam flowmeter. Strength of the phosphate solution is adjusted to maintain a PO_4 excess in the boiler water of 40 to 50 ppm.



4 A short circuit in the large tanks was overcome with suitable baffles

The boilers are 4-drum Stirling type. Originally the phosphate went into the top rear or feed drum. But sludge accumulation completely plugged two rows of tubes from the feed drums on all boilers. No improvement had resulted from introducing the solution into the feed trough of the drum so introduction was changed to the longitudinal center of the top center drum. Improvement was marked, but the sludge problem was far from solved.

Magnesium Reduced. Increasing the pH of the softener effluent reduced the residual magnesium in the treated water to nearly zero. As a result, there was much less magnesium phosphate sludge in the boilers. Before the reduction of magnesium, the sludge was very sticky and had a consistency about like face cream, but this characteristic was practically eliminated by lowering the magnesium content. But there still remained the problem of removing the sludge and keeping it from concentrating in localized areas. A dispersive tannin was tried without success. Experiments with internal treatment of a ferrous mixture also failed. Disodium phosphate replaced sodium hexametaphosphate, which improved sludge conditions as



5 Hot lime-soda softeners were made from 30x30-ft raw-water tanks. Changing the flat plate above the conical baffle to a saucer shape improved chemical mixing

well as reducing line and pump corrosion.

Shift in Treatment. At about this time came a water-treatment sales-service man calling the serial numbers of his products as a football quarterback calls signals. Memory is a little hazy on the point, but it seems that in the signal calling, the word "shift" meant shift to his company's products. A shift was made. After laboratory trials, sodium aluminate (Nalco 680) was fed into the softeners along with the lime-and-soda ash. In addition to its effect as a coagulant, it lowered the residual hardness in the softened water more than would be expected from the amount fed. Because of the reduction in residual hardness the amount of sludge formed in the boilers was correspondingly reduced. And because of better coagulation, filter performance was improved.

An organic treatment was applied to the boiler-feed-pump suction. Character of the sludge in the boiler water improved immediately. Since using this material, sludge has remained uniformly suspended throughout the boiler water, and sludge removal with the blowdown has been comparable to the removal of dissolved solids. Another feature of the organic treatment is the fact that, in all boilers where this material is used in the refinery, a "stain" appeared on the drums and heating surfaces. It is claimed that this action is an aid in reducing corrosion. The writer will go along with this claim although, fortunately, this property did not need to be investigated.

Effect on Valve Stems. Feedwater-regulator valve stems and seats, which were scale-coated before the use of the organic treatment to such an extent that frequent mechanical cleaning was necessary, no longer give trouble. Because of its action on the regulator valves, the organic feed was divided so most of it was fed to the system immediately after the filters to protect the lines, pumps, and particularly the deaerating-heater internals. Periodic mechanical cleaning of the heater trays had been necessary before the pretreatment with organic material was started. Not only was the coating on the heater internals sloughed off, but the heaters have remained clean continuously.

Hot Lime-Soda. At Stanolind Station No. 2, a hot lime-soda external phosphate-treating plant was put into service for five 200,000-lb-per-hr boilers. This consists primarily of a 33-ft diameter x 21-ft straight-side cone-bottom primary softener, a 30-ft diameter x 16-ft straight-side cone-bottom secondary unit, and vertical anthracite filters. Oversized vent condensers on the deaerating heater furnish condensate for desuperheating. The system operates at 10 psig. This plant is a World War II baby; consequently, its design is limited substantially to essentials only.

Aside from the headaches normal to initiating a new system that handles large quantities of water at temperatures above the boiling point at atmospheric pressure, we attempted to operate the system to produce boiler water with a total alkalinity of not more than 20% of the total dissolved-solids content. Calcium sulphate was used and part of the boiler blowdown was returned to the primary softener. The attempt was quickly abandoned. Solomon's control problem with 1000 wives was duck soup compared to the control problem represented by this setup. Alkalinities higher than 20% of the total dissolved-solids were accepted. It was found that high alkalinity in these boilers did not greatly affect the carryover in the steam.

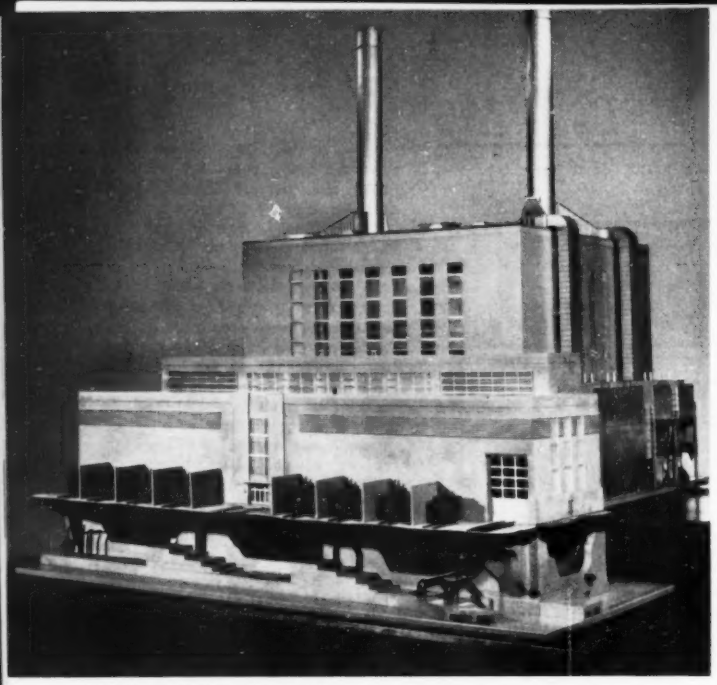
Carryover Reduced. Revamping the steam-drum internals was a large factor in reducing carryover. Another was the use of organic treatment containing an anti-foam material. Action of this material was so fast and so complete in collapsing bubble froth that a solution feed was substituted for a ball feed to assure a continuous flow of anti-foam material to the boilers. At this station, two good treating precepts are now being followed; namely, whatever you are going to do to the water, do all you can outside the boiler and refrain as much as possible from making the boiler a chemical retort.

The tale is told to date. At least we have hit most of the high spots. The steam and power personnel at the refinery are in the throes of starting up a huge treating plant to produce 100% makeup for new boilers operating at 1500 psig with a lime-soda phosphate system. When this job is buttoned up, it will be another story. So with that thought in mind, let's wind up our yarn and cautiously creep over to the new plant and inquire, "How's she doin'?"

CORRECTION

In the article, "Capacitors Improve Pf and Cut Costs" (Dec POWER, p 123), the capacitor and load inductive current waves in Fig. 2 are 180 deg out of their correct phase position. As a result, the capacitive current was shown lagging the applied voltage while the inductive current led by 90 deg.

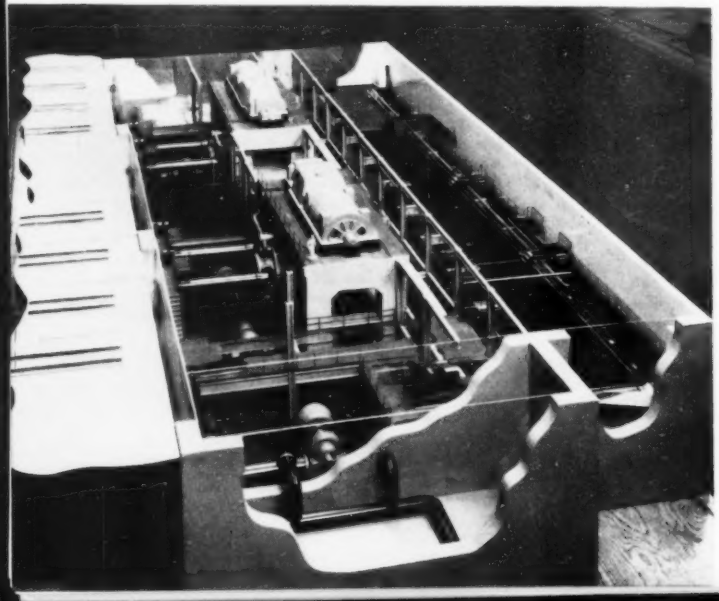
By interchanging the two sine waves both currents will be shown in their correct relation to the applied voltage and load power current.



COMPLETED MODEL OF STATION with wall panels in place, built to scale of one-quarter in. to the foot. View shows the main entrance between transformer banks

Model Helps Design Sunbury Station

TURBINE ROOM AND BASEMENT of the model under construction. Two 75,000-kw turbines take 1250-psig 950-F steam and exhaust to 42,500-sq-ft 2-pass condensers



Building in miniature prior to the actual construction caught planning errors before they became costly to correct. Method helped designers visualize problems, and will aid in training station's operating crew

► A SCALE MODEL guides the Pennsylvania Power & Light Co in constructing the world's largest anthracite-burning steam-electric generating plant. This is Sunbury Station, on the Susquehanna River near Sunbury, Pa., scheduled for initial operation about the middle of 1949.

Early in the drawing-board stage of design the need for a model became apparent. There were no precedents for solution of many of the problems and a 3-dimensional check was considered essential. A scale model gave the answers and proved important insurance against costly design changes during actual plant construction.

The firm selected to undertake construction of the Sunbury model was Donald L Atkins Associates, Inc of Natick, Mass. During the war they built a wide variety of miniatures for the armed forces. In fact, industrial model building has grown as a new industry.

Model Takes Form. The model started taking form as soon as the drawings came off the drafting boards. Nearly three hundred were turned over to the model builder before the job was done. This compared with over 1500 drawings needed to build the actual plant. Working on a scale of $\frac{1}{4}$ in. to the foot, each design step was translated into three dimensions, 1/48th actual plant size.

The model, which cost over $20,000, needed in excess of 5500 man-hours to build, and has saved many times its cost and thousands of vital construction man-hours in the hurry-up job of getting this new station on the line.

Selection of materials for the model was limited by the close tolerances that had to be met. Nonwarping, easy machining, strength and appearance are important factors. Brass was chosen for the main structural members, and wood for other parts. Most of the mechanical equipment was made of wood. Where many duplicates of units were required, they were cast in plastic. All solid floors and roofs were reproduced in transparent plastic to afford full view of the interior. The model reproduced every pipe 6 in. in diameter

and over, and often smaller sizes when necessary to define the function of certain equipment. Plastic rods that could be bent without undue distortion were used. Each piping system was painted a distinctive color for easy identification and ready tracing.

Outside walls of the model, of $\frac{1}{8}$th-in. aluminum, are painted inside and out to indicate the tile interior and the brick exterior. Windows are translucent plastic scribed to simulate glass block.

The model was built in three sections, each weighing about 600 lb. Sections, mounted on tables for easy viewing, may be joined together in a single unit or moved apart to provide ready access to interiors for study. Walls are removable so every section of the plant may be brought into view.

Model Completed. Nearly a year elapsed between the time the first drawings went to the model builder and the complete model was received by PP&L. Meanwhile, at the site, work was in full progress. Land was cleared and leveled, and intake and discharge tunnels, pilings, foundations, river-bank dikes and some nine miles of railroad were installed. As the model took shape it began to pay dividends as a proving ground for the designer's drawings. As errors showed up in the model it was relatively inexpensive to correct them in both drawings and model. Without this procedure many discrepancies might have passed unnoticed until actual construction. To correct them in the field would have been costly.

Upon delivery the model was closely studied by the engineering, construction and operating departments. It has been an invaluable aid in visualizing interferences, clearances and layout of equipment in ample time to make design changes rather than expensive field changes. The model has been studied from the standpoints of architecture and structure, location of pipelines, coal, air and gas distribution, lighting and control equipment. A quick look at the model has often saved long hours of blueprint study.

Providing good lighting was a relatively simple problem for the illuminating engineers. In the model they could see the actual conditions under which they would have to light various locations, the interferences they would meet and the types of structure available for mounting fixtures and switches.

The model is used to train operators well in advance of the time they will have access to the completed plant. Actual miniature equipment can be seen in views that will be gone forever when the plant's walls, floors and partitions are in place. The model will familiarize operators not only with their own stations but with all related jobs, a decided advantage. Maintenance personnel can study equipment arrangement to develop methods of overhaul and repair. After the plant runs with a fully trained crew the model is expected to be helpful in working out any operating problems as they arise.

The model is also used for publicity purposes, being exhibited in various places where the public can see it and form an impression of the complexity of a modern power plant.

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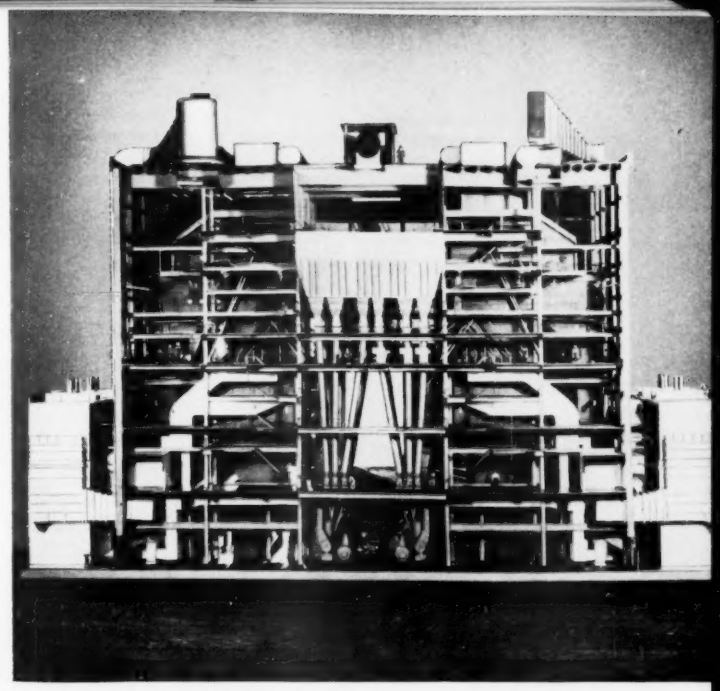
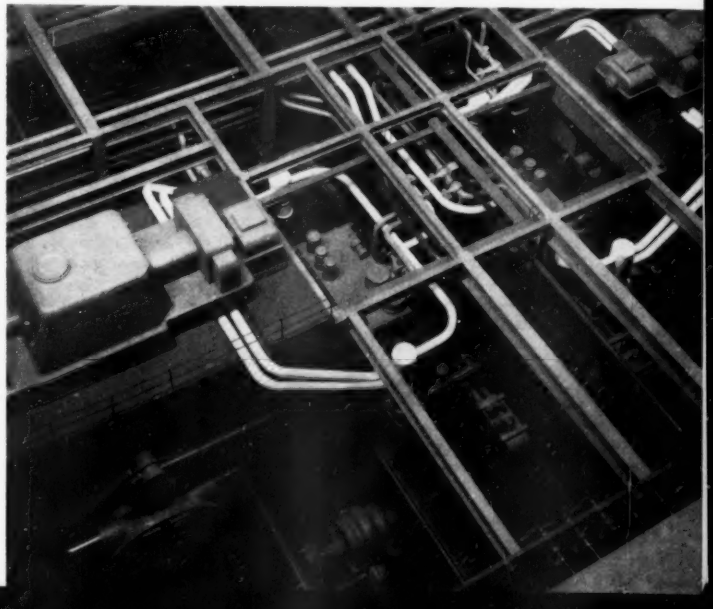
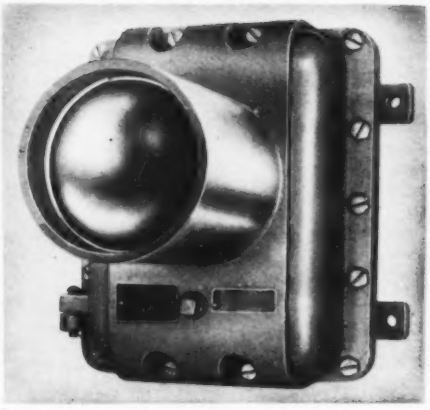


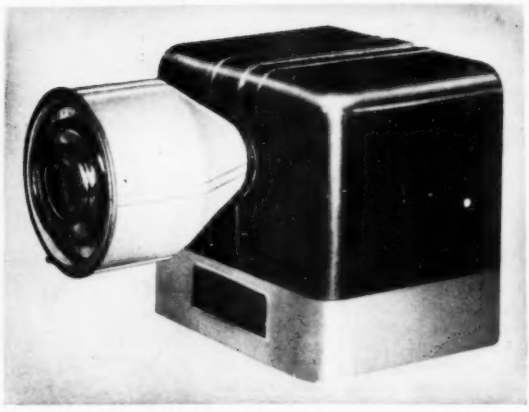
BOILER ROOM AND BUNKER ARRANGEMENTS can be closely studied after removing the wall panel. Note mills and fans in basement, dust collectors located outdoors

PIPING CLEARANCES AROUND TURBINE can be thoroughly checked when laid out in model like this one. Two lowest-pressure heaters are in the condenser inlet





1 Explosionproof case of this photoelectric relay is designed to be used in hazardous gas locations



2 This lens barrel has a large lens, designed to increase the sensitivity of an inexpensive low-sensitivity photoelectric relay

Here Are Know-How Rules for Photoelectric-Relay Applications

To apply photo relays remember their limitations for factors like light sensitivity, voltage, frequency, operating rate, response speed, contact ratings, light source, temperature

By ERNEST JELLINEK

Electronic and Regulator Control
Engrg Div, General Electric Co

► PHOTOTUBES AND RELAYS have come into wide use in a great variety of power and industrial applications. They are, in general, comparatively simple devices that are easily applied when applications are made with an understanding of tube and relay requirements and limitations.

Usually, phototubes in photoelectric relays are the photoemissive type, Fig. 3. This means they have a cathode coated with a substance that emits electrons when light strikes it. These electrons, collected by an anode wire when voltage of the proper polarity is applied, form a photoelectric current.

There are several types of cathode coatings. Each has a different response to various colors. The two coatings in general use are *S*1 and *S*4. Phototubes that have an *S*1 coating are red sensitive, whereas those with an *S*4 coating are blue sensitive.

Light Sensitivity. Fig. 4 shows the variation of sensitivity to colors of equal light energy. The *S*4 response is very high in the blue end of the spectrum and drops off quickly at other wave lengths, both lower and higher. The *S*1, on the other hand, has sensitivity to all visible wave lengths and to infrared. Curve for the wave-length content of light from a Mazda lamp shows that the best response when using incandescent lamps is from a red-sensitive phototube. It is also especially good for use on radiation from hot bodies.

The blue-sensitive tube is used only in special cases requiring sensitivity to blue or where considerable extraneous infrared radiation is present. Note that the blue-sensitive cathode coating is destroyed at temperatures over 167 F, whereas the red-sensitive coating withstands 212 F.

Another curve in Fig. 4 shows the response of the human eye to various colors and indicates that phototubes do not "see" color variations as we do. The eye's retina contains thousands of microscopic spots divided into groups with sensitivity to different colors. Output of each of these spots is blended to give the brain the impression of color.

The phototube, however, is similar to only one of these spots; it has only one output, namely, current. This current may be different for equal light energies of different color, but it is also different for unequal light energies of the same color. It is difficult, therefore, to produce a definite change of phototube current with a small change in color. This is because some variations will also be produced by other effects, such as changes in reflectivity of the surface, or in line voltage.

What kind of signal must we obtain to operate the standard relays? A series of photoelectric relays is available that operates at various light levels ranging down to one foot-candle, but generally it operates at about five foot-candles.

Of course, the more sensitive the unit, the more complex the circuit.

General-purpose photoelectric relays are merely on-off devices, not ordinarily designed to hold close limits. Many types operate on a light change as small as 10%, but it is difficult to obtain this amount consistently for any period of time. Operating point is changed by factors such as aging of lamp and phototube, accumulation of dust or moisture on lenses or in atmosphere, and variations of line voltage.

To eliminate need for periodic adjustment of the sensitivity setting, it is desirable to operate on at least a 50% light change. On the other hand, there is available a photoelectric relay that responds to a change of ½ foot-candle at any light level from 1 to 10 foot-candles.

The term *light level* refers to the intensity of illumination, measured in foot-candles, and indicates the amount of light falling on a unit area. Light level decreases as the square of the distance to the light source. Saying that a photoelectric relay operates at a certain light level means that the phototube is located at a point where this light level exists, and that its cathode is completely illuminated by this light.

Similarly, the required change in light level must occur right on the phototube cathode. The light beam is usually larger than the receiving lens. So it is not sufficient to interrupt only half the area of the beam itself, but half of the part received by the phototube must be broken.

Other Factors. In addition to basing the choice of the proper general-purpose photoelectric relay on the characteristics of the light for the particular application, the other features to consider are:

1. *Voltage and frequency.* Units for 115 and 230 v, 50 to 60 cycles, are common, although some equipments are available for 25 cycles or dc. Photoelectric relays should not be connected to circuits where voltage varies over 5%, or on which large surges occur. A lighting circuit is most desirable but a voltage stabilizing transformer may be used. Power drawn by the relay is generally under 10 volt-amperes and the light source requires 20. Light intensity of the source varies as voltage cubed.

2. *Rate of operation.* Various photoelectric relays are designed for operating from 150 to 600 times per minute. In most applications the rate is limited not by the relay but by the device as, for instance, when a solenoid or counter is energized by the relay. For counting at speeds higher than 600 per minute, an electronic scaling unit can be used to divide the count by any convenient number and thus operate the magnetic relay at a lower speed.

Remember, also, that at high speeds the number of operations add up quickly so a relay designed even for several million operations may be worn out in a short time. For high-speed small-load operation, a photoelectric relay, utilizing a telephone-type relay, is desirable as it has a life of about 25 million operations.

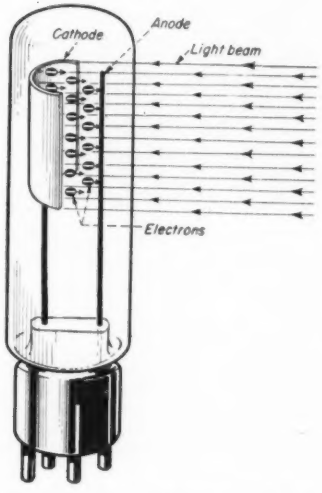
3. *Speed of response* is not generally a factor unless split-second operation is desired. A relay is available that operates within 0.015 sec after the light change, which may be as short as 0.001 second.

4. *Relay-contact ratings* vary from 1 amp to ½-hp motor starting on ac, and much lower for dc circuits. Selection must be based on the particular load with consideration to special conditions, such as inductive or incandescent lamp loads. A spark suppresser consisting of a capacitor and resistor in series may be connected across inductive loads such as contactor coils to reduce arcing and wear of the contacts.

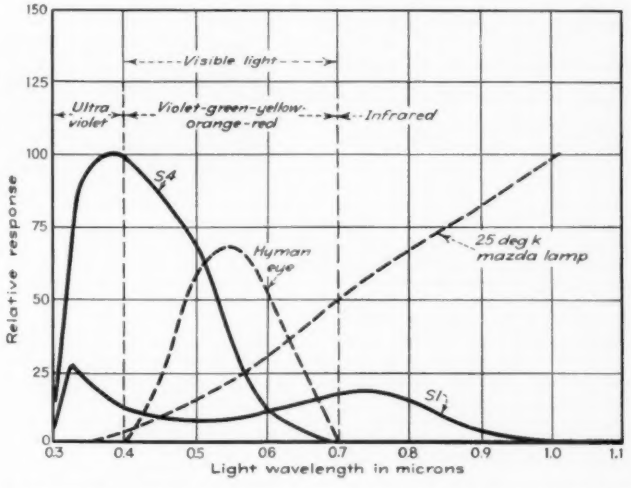
5. *Enclosures.* Standard photoelectric relays are available in several enclosures, which should be selected for the location to which they are suited. Relays may be obtained in ventilated, dust-tight, weathertight and explosion-proof cases. Fig. 1 shows the last type.

6. *Light sources* must be selected for their ability to provide necessary light and housing for the location. Light provided is roughly proportional to the area of the lens, so use a large lens unit for long-distance work. A light source with a short-focal-length lens combination is available for producing a spot of light within a few inches for web scanning.

7. *Remote phototube holder* is a small housing for placing the phototube at the point of optimum light conditions when the relay unit cannot be placed there. In many circuits the phototube voltage is ac, so the cable running to



3 Phototube cathode has coating that emits electrons as light strikes it



4 Phototube sensitivity to changes in color with equal light intensity, S4 coating is sensitive to spectrum's blue end, while S1 is to all light and infrared

the remote phototube holder forms a shunt capacitor. Because of the capacity effect, sensitivity of the relay is seriously reduced if the cable is more than 7 ft long. With a dc phototube, sensitivity will not be reduced, but response time will be increased.

8. *Filters* may be used to increase the contrast between certain colors. Also, an infrared filter may be placed over the light source to provide an invisible light beam if desired.

9. *Optical accessories* may be used to create the proper light conditions for satisfactory operation. Lenses increase the amount of light available and the directivity of both the light beam and the phototube, Fig. 4. Mirrors can reflect the beam around corners or criss-cross it to cover a large area.

This and the previous article (POWER, Jan. pp 76-78) give the principles of putting a light beam to work inexpensively and efficiently with a general-purpose photoelectric relay. While it has been shown how useful this device can be, certain limitations must be understood: (1) Only on-off action can be obtained. (2) Operation is most successful on rapid, complete changes in operating light. Fifty percent or more light change is desirable. (3) Photoelectric response differs from that of the eye. It cannot see variations in color as easily as we can.

Other Equipment Types. General-purpose photoelectric relays are simple devices, which by proper installation can be made suitable to the user's needs. There are, in addition, many photoelectric equipments built for other purposes, some of which are extremely complex. Many are designed to do some of the jobs described, but with fewer limitations.

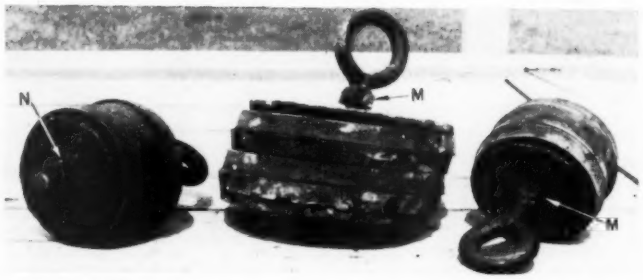
For example a photoelectric pyrometer control also operates from infrared radiations of hot bodies, but can hold the temperature to close limits. It can also distinguish smaller light changes than the general-purpose unit.

With the advent of smoke-abatement ordinances, a general-purpose photoelectric relay may be used to sound an alarm when smoke in the breeching or stack becomes too dense. It may also control dampers or steam jets to decrease excessive smoke automatically. More specialized equipments are available for indicating the Ringlemann smoke density on a meter or recorder. In these, relays may be set to operate at one or two preset densities. With a 2-point control, dampers or blowers may be controlled to keep smoke density between the limits of best combustion efficiency.

Photoelectric controls for cutoff register are designed for higher speeds and better accuracy than the general-purpose relay. A photoelectric relay and light source operating on chopped light is capable of covering a distance of 1000 ft with an invisible barrier. It is understandable that these devices are more costly but they are necessary where the general-purpose unit is not suitable.

Changes Valves and Taps Tanks Under Pressure

There are five methods, says M H Pearce, Jefferson, Texas, to change a valve on a liquid line under pressure, or make a pipe connection to a full tank without removing the liquid



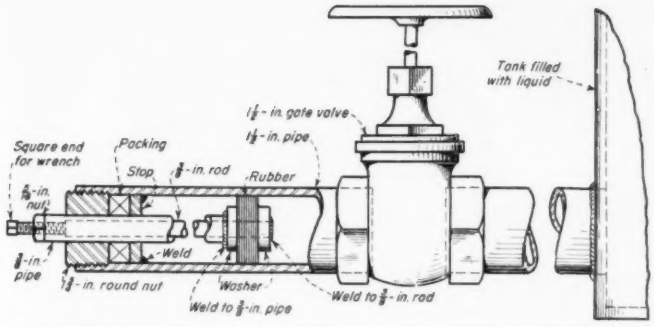
1 **SEALING PLUGS.** These plugs have neoprene or other synthetic-rubber disks compressed between two steel washers with a nut that threads onto an eyebolt

► PLANT ENGINEERS often have to replace tank-control valves or add a new pipe connection to a tank used to store hydrocarbons or other inflammable fluids. Frequently this job has to be done when the tank is full, so a temporary stop must be put behind the valve to close the line during the change. Any one of a number of methods may be used for this job. Here are five that have been applied successfully.

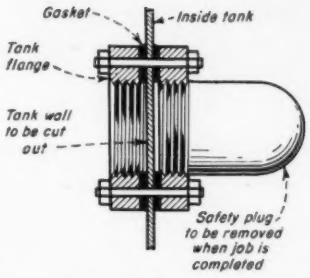
Change Tank Valve. Fig. 2 shows a method worked out for changing a valve on a fuel-oil tank at a time when the tank could not be emptied. The valve was a 1½-in. gate with full port opening through its body. The flow line to the valve was removed, and the replacement device screwed into the latter as shown.

This device was built into a section of 1½-in. pipe threaded on one end to screw into the valve and on the other on the inside for a 1¾-in. round nut. Far enough inside the pipe to allow space for the round nut and ring of square packing, a disk is welded in place. The round nut and disk have a hole in their center for a ⅜-in. pipe to pass through.

The plunger or pipe stop is made of rubber disks between two metal washers. One washer is welded to one end



2 CHANGING VALVE. This method was developed to change a valve on tank containing fuel oil at a time when tank could not be emptied to do the job



3 TANK CONNECTION. To connect an 8-in. line to a fuel oil-storage tank

of a ⅜-in. pipe, long enough to extend well out through the round nut. A ⅜-in. rod passes through the pipe and rubber disks and is welded to the metal washer at the back of the disks. The free end of this rod is threaded for a 5/16-in. nut and is squared for a wrench.

To remove the valve the plunger is assembled in the 1½-in. pipe and the round nut tightened on the packing to seal against leakage around the ⅜-in. pipe. The assembly is screwed into the valve, which is then opened and the plunger pushed through until it is between the valve and tank.

By tightening the 5/16-in. nut while holding the square end of the rod in a wrench, the washers are pulled together until the rubber disks are forced to a sealing fit in the pipe. The round nut is then loosened, allowing the 1½-in. pipe section to be removed and the valve unscrewed without disturbing the seal.

A replacement valve is installed on the tank nipple, the sleeve and round nut put back in place, and the pressure on the rubber disks relieved. When the plunger has been retracted through the valve it is closed and the fuel line connected.

Rubber Bottle. Compressed air in a rubber bottle has been used to close a pipeline behind the valve. The bottle is placed in a similar manner to the plug, Fig. 2, and then inflated with compressed air to seal the line.

Either the device, Fig. 2, an air bottle, or the pipeline expandable plugs, Fig. 1, may be used as sealing members. In any case the equipment seals the pipe, as in Fig. 2. The plugs, Fig. 1, have two steel washers slightly smaller in diameter than the pipe to be closed. One washer has a 1-in. square nut *N* welded to it over a 1⅛-in. center hole. The other washer has a similar hole through its center and is slipped onto a 1-in. eyebolt, which has been threaded to the eye. A nut *M* is threaded on the bolt to the eye and welded in place. Neoprene or other synthetic rubber disks are placed between the steel washers and are expanded against the pipe's walls when the washers are drawn together by turning the eyebolt.

To close a pipe, a plug of correct size is placed behind the valve by a hooked rod worked through a sleeve like Fig. 2. The rod also serves as an extension wrench to tighten the plug in place. Once the plug is tightened the sleeve and hooked rod can be removed to replace the valve.

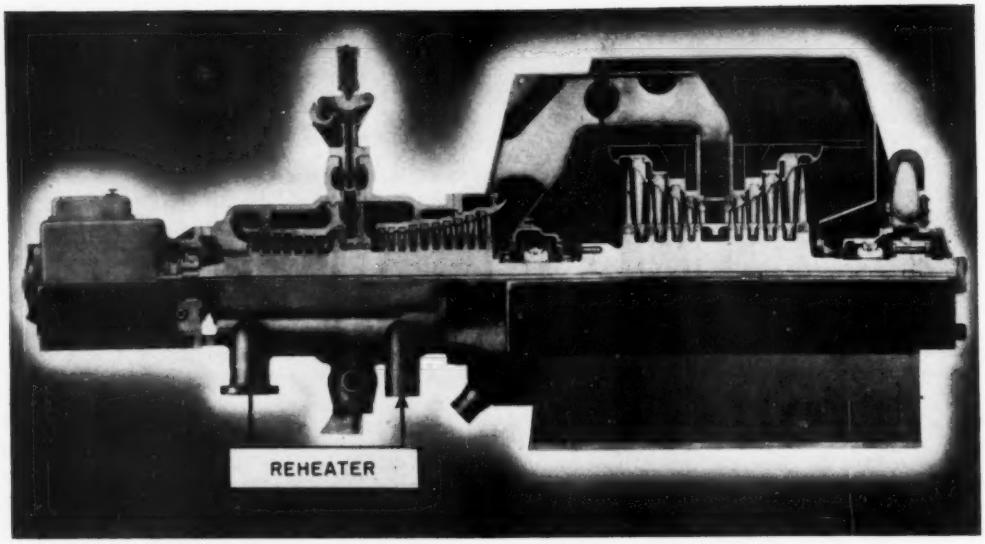
Weld on Flange. A tank may be tapped with a tapping machine, such as is used for making taps on water mains. A flange of the desired size is first welded to the tank around the place where the tap is to be made. To weld the flange, a light bead with 1/16-in. rod is laid on, and the desired depth of weld built up gradually. When welding a flange to a tank containing inflammable liquids, such a bead is safe, but have a good head of liquid above the weld. With the flange welded in place set up the tapping machine and make the tap in the usual manner.

If the required opening in the tank is larger than the tapping machine, use the machine with a spotting device. Weld the flange onto the tank and screw a nipple with a gate valve into it. Another nipple with a collar, into which a disk has been fitted, is screwed into the valve. At the edge of the disk, weld a collar for the tapping machine. Place the collar so that the drill will contact the flange on the tank. Then, by turning the collar with its disk, a circle of holes can be drilled through the tank and a disk removed the size of the desired hole.

Fig. 3 shows a method used to cut an 8-in. line into a fuel-storage tank. The outer flange and gasket were supported on the outside of the tank and the bolt circle laid out. Two holes, to correspond with bottom and top bolts, were drilled through the tank wall and plugged with tapered wooden plugs. Then, when the liquid was below the level of the projected opening, the plugs were withdrawn, and the inner flange and bull plug placed.

This was done through the manhole by one man, with mask and lifeline, who worked inside the tank less than 3 min. The inner flange had previously been prepared by having nuts of the proper size brazed around the bolt holes. Two studs of the proper length were screwed into the top and bottom nuts before placing the inner flange. Then all the man inside the tank had to do was stab the two studs through the holes indicated by the fingers of light entering the tank.

One by one the other bolt holes were drilled through the tank wall without loss of fluid. The holes in the inner flange had been plugged with cork disks. They were forced ahead of the bolts as they were placed after drilling the corresponding hole through the tank plate. After the bolts were in place, tank wall inside the flanges was cut out, the valve installed and a sleeve similar to Fig. 2 made up. Through this sleeve a 2-in. pipe with slotted end was arranged to work. The outer end of the pipe was closed with a welded disk. Slotted end of the pipe was pushed in until it engaged a cross welded within the plug, after which a wrench on the 2-in. pipe backed out the plug and left the line free. In one instance, the plug was allowed to fall to the bottom of the tank. In another case, a swivel was welded to the bulge on the plug, and a chain attached. The chain's free end was connected to the manhole. After the plug was unscrewed, it was pulled to the surface for reuse.



NEW DESIGN OF REHEAT TURBINE for operation at 3600 rpm with throttle steam at 1450 psig, 1000 F, reheat to 1000 F. This 80,000-kw unit has initial and reheated steam enter at midpoint of h-p casing, helps reduce temperature strains

Reheat Cycle Takes Share Of Load in New Extensions

History and future of reheat cycle applications discussed in six papers presented at past annual meeting of ASME. Using high pressures and temperatures, heat rate can be reduced by about 6% when reheating with no added operating difficulties

► SIX PAPERS PRESENTED at the ASME annual meeting in New York City during December 1948 comprehensively reviewed the problems and advantages of using the reheat cycle in central stations. They were:

Developments in Resuperheating in Steam Power Plants, by E E Harris and A O White, General Electric Co.

Steam Turbines for Resuperheat Cycle, by E E Parker, General Electric Co.

Operating Experiences in Connection With Regenerative Reheat Turbine Installation, by C A Robertson, Allis-Chalmers Manufacturing Co.

High-Pressure Boilers With Reheaters, by W H Rowand, A E Raynor and F X Gilg, The Babcock & Wilcox Co.

Modern Reheat Boilers, by W S Patterson, Combustion Engineering Co, Inc.

Steam Generating Equipment for Resuperheating Cycles, by M Frisch, Foster Wheeler Corp.

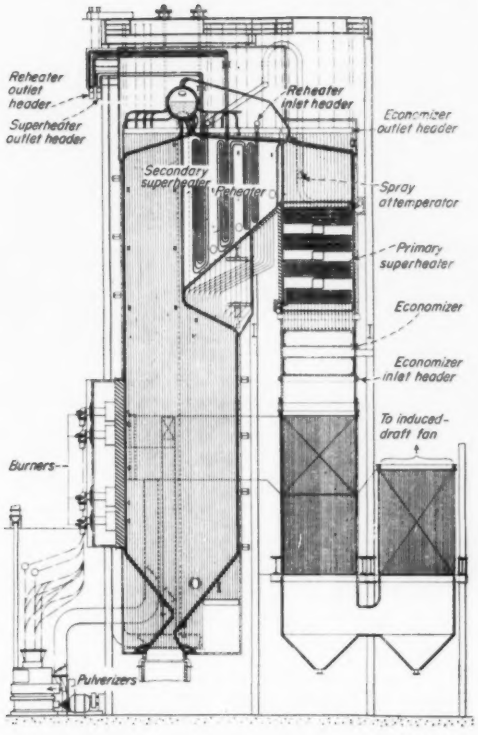
History. Starting around 1924 reheat installations were made in the U. S. that now total about 2,460,000 kw. These are units where the resuperheated steam returns to the same turbine. In addition, there are about 120,000 kw in noncondensing turbines that supply steam to older l-p units with resuperheating between old and new.

During the first part of this period the reheat arrangement was used to realize the heat economy of high pressures with an initial steam temperature of only 750 F. By resuperheating, the moisture at exhaust was kept below the allowable 12%. Reheating provisions ranged from separately fired superheaters, to steam-to-steam resuperheating, but most had reheaters in the boiler.

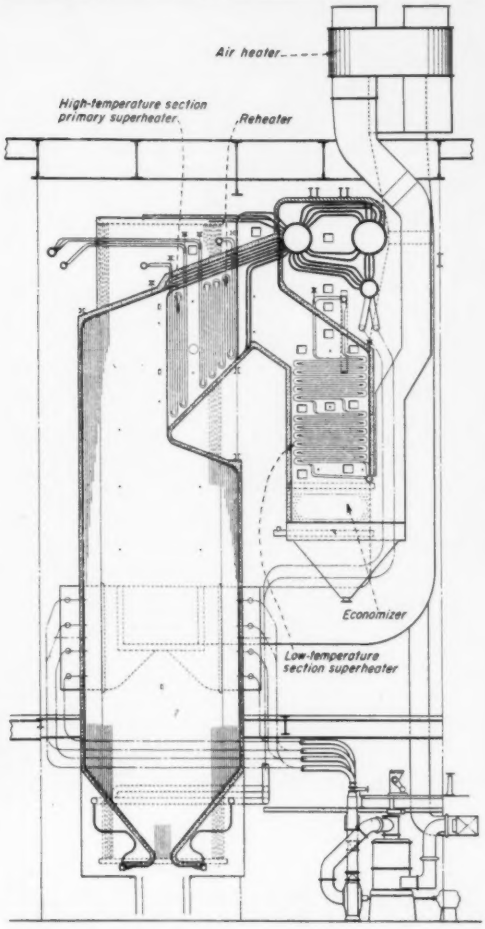
At the present time, about 1,800,000 kw of reheat units are under construction or on order. Majority of these installations will use initial pressures above 1400 psig, and initial and reheat temperatures of 1000 F and above.

Operating Conditions. The renewed acceptance of reheat units comes from the 3 to 6% reduction in heat rate that may be realized when compared with a non-reheat unit operating with the same initial conditions. Amount of reduction depends on cycle arrangement, and the pressure and temperatures at which reheating is carried out. Another advantage lies in the fewer stages operating in the moisture region. The concurrent elimination and reduction of moisture in the lower stages increases the useful life of these turbine parts.

Starting conditions are relatively sim-



STEAM GENERATOR with reheater, produces 670,000 lb per hr at 1492 psig, 1000 F, and reheat at 406 psig to 1000 F temp

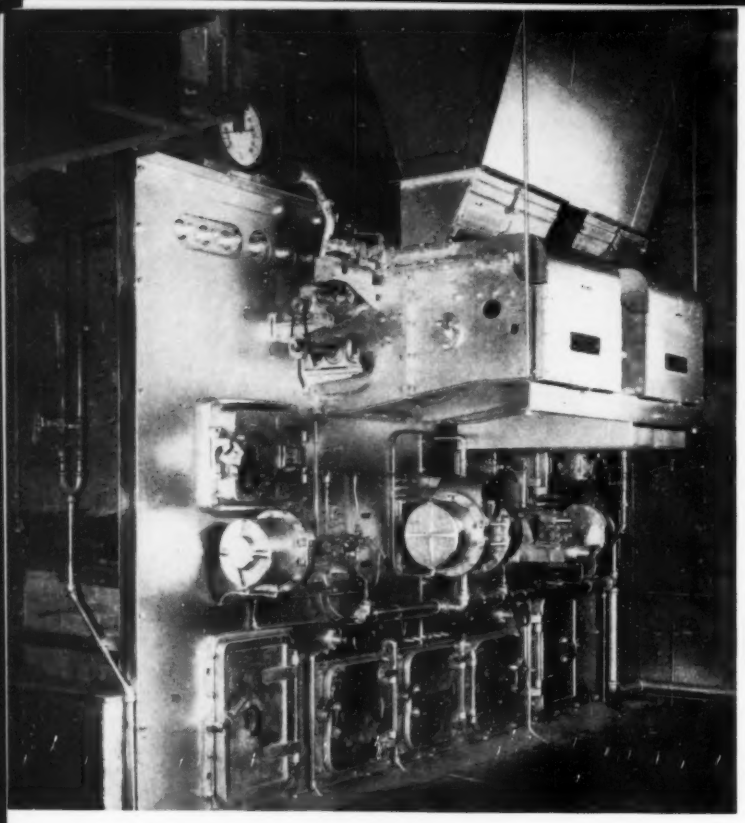


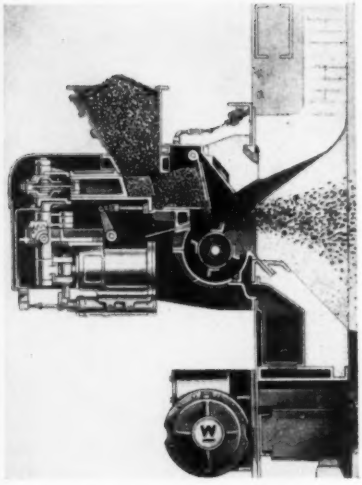
RADIANT-TYPE BOILER to generate 575,000-lb-per-hr steam at 1500 psig, 1000 F, and reheat at 417 psig, 697 to 1000 F

ple and depend on the layout of intercepting and unloading valves provided. A normal startup procedure may be summarized as: (1) drain superheater, reheater and piping (2) start fire (3) heat up high-pressure lines (4) warm up reheat lines by closing intercepting valves and bypassing h-p steam into one of the reheat lines for circulation through reheater and exhausting to a l-p header (5) start warming up cold turbine as soon as a low pressure is established in boiler (6) increase turbine speed in accordance with usual procedure (7) put unit on line and increase load as fast as thermal expansions permit. For short shutdowns up to two days, bottle up turbine and boiler to maintain heat.

Steam generators built for reheat cycles employing temperatures on the order of 1000 F have about 40% of their heat absorption take place in the combined superheating and resuperheating surface. This high-temperature heat absorption and the range of load over which steam temperatures must be controlled influence the boiler's design. Despite these extra considerations the appearance of a steam generator including a reheater does not differ greatly from other high-pressure units. One boiler manufacturer reports that when comparing reheat and non-reheat boilers to produce an equal number of kw capacity for steam conditions of 1500 psig, 1000 F, the reheat unit costs about 5% more, while for steam conditions of 2035 psig and 1050 F the reheat unit costs about 7.5% additional.

E E Harris and A O White stated that a number of utilities indicated studies showed the fuel saving by reheat provided an adequate return on the additional investment involved, and hoped these studies would be made available to the industry. Following this line of thought, M J Steinberg, Consolidated Edison Co of New York, Inc, in a discussion from the floor stated that he felt economic justification was limited to those reheat projects under way, and yet there must be many instances where reheat was not found to be economically justified. Apparently there is no uniformity in evaluation procedures and possibly inadequate accounting of all factors. Consideration of future probabilities often leads to wide differences of opinion and judgment. He proposed that a symposium on the evaluation of reheat proposals be held in the near future to supplement the present series of papers. This was the only question, as fuel saving and operating flexibility were proved.





1 In each feeder a pair of oppositely moving feed rams push coal toward furnace, against spring-loaded equalizer plates reciprocating across face of coal, shredding it away at uniform rate to drop to overthrow distributing rotor

←

2 Stoker is set high to facilitate ash removal; note ash doors at each side

New Spreader Stoker Solves Problem

Clapp baby foods division, at Rochester, N. Y., installs a 40,000-lb-per-hr integral-furnace boiler to meet load growth quickly and economically; spreader unit with an oscillating grate meets space limitations making an underfeed unsuitable

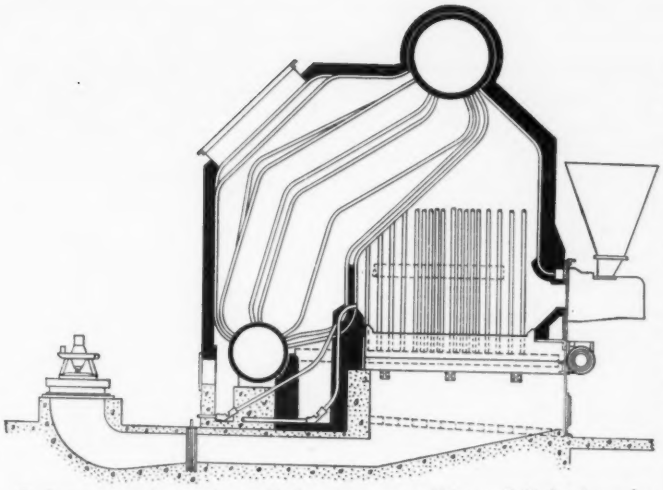
By D J MOSSHART, *Stoker Division, Westinghouse Electric Corp.*

► EARLY IN 1946 the Rochester, N. Y. plant of Clapp Baby Foods Div, American Home Foods, Inc, faced an anticipated increase in steam demand that would make it exceed installed boiler output. Estimates indicated the advisability of adding at least 40,000 lb per hr of steam-generating capacity. Existing equipment, consisting of two hrt boilers, one low-head 3-drum watertube boiler and one small firebox boiler, all fired by single-retort underfeed stokers, occupied all available space in a boiler room, below ground level and excavated to bedrock. Winter loads required all four boilers.

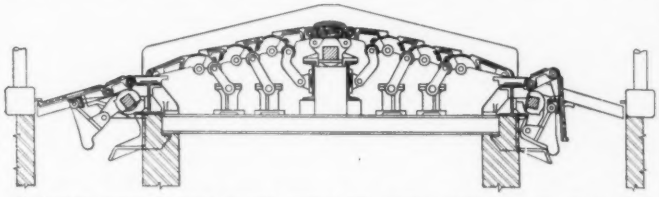
Expansion Problem. This plant processes a wide variety of foodstuffs. Operation is somewhat seasonal, so annual load factor is rather low. Thus it was desirable to keep capital investment as low as possible. Anticipated new demand in the near future required early installation of additional equipment. These combined factors of investment and time impelled studies to find means of installing the required capacity in available space without production loss. This meant using the space occupied by the small firebox boiler.

It was found that a 40,000-lb-per-hr integral-furnace boiler could be fitted in. Since this capacity would not be practical for a single-retort stoker under the existing requirements and space could not be provided for a multiple-retort unit, it was decided to install a spreader stoker, capable of sustained full-load output with only the one boiler in service. The problem was referred to the stoker manufacturers and a newly developed spreader selected.

New Spreader Design. This Westinghouse design adapts to spreader



3 Cross section shows stoker and boiler arrangement. Using available headroom for high setting made it possible to provide manual ash removal at the floor level



4 Section across furnace reveals central link grate, which conveys ash to discharge grates; shown in normal position at left, in open discharge position at right

for American Home Foods

practice the link-grate construction long used in underfeed units. The articulated-link central grate, Fig. 4, functions as a conveyor to move ash sideward to ash-discharge grates. These are also in articulated sections and, when opened to dump ash, break up any refuse accumulations and insure free discharge. As only a small proportion of total fuel burns over the ash grates, discharge is handled without capacity loss or increase of excess air. For the same reason, ash removal from pits below the discharge grates is accomplished without affecting boiler operation.

Distribution of raw fuel is confined to the central or active grate, where fuel burns with an air deficiency. This minimizes entrainment of solid fuel particles in the gas stream. To effect complete combustion in the space above the raw coal's trajectory, excess air from ash-discharge grates and secondary air supplied through side-wall nozzles mix with combustible gas evolved over the central grate. Secondary-air jets supply the energy needed for high turbulence.

Overthrow rotors distribute fuel over the grates; these rotors and the feeder rams that supply them are hydraulically actuated, as is the link-grate section. This completely hydraulic-drive system is so designed that automatic control of fuel feed in proportion to air flow (fuel-air ratio control) forms an integral element.

Layout of Unit. Although floor space at the Clapp plant is limited, headroom is not. Thus in planning the new unit advantage was taken of this condition and the boiler and stoker set high enough for manual removal of ash from pits at floor level, Fig. 3. Some sacrifice in appearance was made for the sake of this considerable convenience to the operator. Fig. 2 shows the stoker installed, with large ash-removal doors at each side.

The stoker has a grate area of 108 sq ft. This serves a steam generator having 5950 sq ft of heat-absorbing surface and a furnace volume (including open pass) of about 1325 cu ft.

To augment draft of existing stack, a low-capacity induced-draft fan was installed. Existing flue layout and available space, however, did not permit installation of a high-efficiency flue-dust collector. Representing a compromise, a baffled settling chamber in the flue system traps up to 40% of flue dust. Material thus caught returns to the furnace by way of a continuously operating ejector.

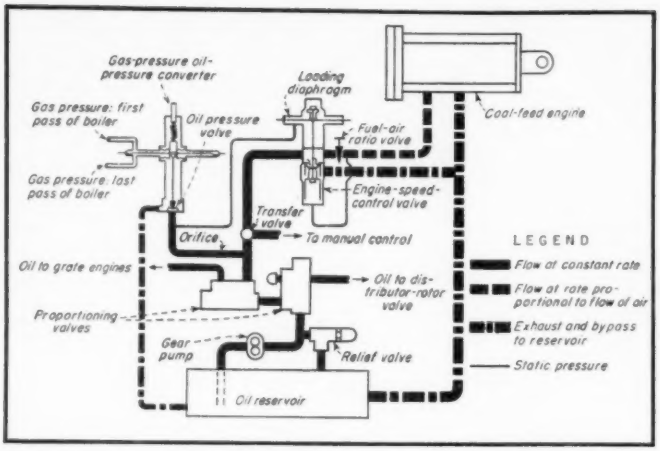
Feeder Design. Operation of the coal-feeding and distributing mechanism can be seen in Fig. 1. Each feeder consists of a pair of oppositely moving feed rams, which push coal toward the furnace, against spring-loaded equalizer plates. These reciprocate across the coal stream's face, shredding away coal at a uniform rate. The overthrow distributing rotor below propels coal to the grate.

The equalizer plates swing to a spill plate, adjustable to cause coal to fall on a desired part of the arc of travel of the rotor blades. By this means, trajectory of fuel particles and distribution of fuel is effected. This is a secondary adjustment; primary control is by rotor speed. In the hydraulic drive system, the rotor is powered separately by a hydraulic motor. To prevent piling fuel in one spot when fuel particles are predominantly of one size, a valve varies rotor speed, over an adjustable range, several times each minute. By these means the operator controls coal distribution positively, regardless of size consist or moisture.

As in Fig. 4, the link-grate section, to which coal distribution is confined by position of distributors and pitch of rotor blades, is actuated by a hydraulic mechanism, which oscillates the square shaft beneath the grate apex. The resulting wavelike motion conveys ash sideward to discharge grates, also hydraulically actuated. Frequency of grate motion is proportional to fuel feed but ratio is adjustable by the operator over a 5-to-1 range. Normal frequency at full boiler load runs about one cycle of movement in two minutes.

Stoker Operation. In operation, the active fuel bed is held thin—usually not more than one or two in. of fuel on top of a bed of ash. Automatic control of any type can be selected to vary air flow in accordance with steam demand. Automatic fuel-feed control built into the hydraulic drive system measures air flow and adjusts fuel feed in proportion.

Air is supplied to the link grate



5 Diagram shows completely hydraulic system for driving stoker elements. This provides automatic control of fuel feed, in direct proportion to the flow of air

through an orifice and to the ash-discharge grates through dampers to the ashpits. Normally these dampers are throttled so proportionate air flow to various sections of grate surface is governed largely by pressure drop across orifice and dampers.

When ash accumulates on discharge grates, ashpit dampers are opened wide for a few minutes to burn out residual fuel on top of the ash. Operator then closes dampers and opens discharge grates to drop ash into the pits, one side at a time. Closing ashpit dampers and functioning of draft-control system increases air flow to link grate to hold same total flow. Fuel feed is not interrupted or adjusted. There is no change in excess air nor loss of boiler output during ash-dumping operation.

After dropping the ash, discharge grates return to normal position. When enough ash and fuel accumulate on them (a matter of minutes) ashpit dampers are reset to normal operating position.

Operating Experience. This unit went into service in Oct 1947. During the next year several design revisions were made, with no service interruptions from mechanical failures after the first few days of operation. Unit has burned a wide variety of coals from Pennsylvania fields, with ash content up to 17%, fusing temperatures down to 2100 F and sizes up to 3 in. Best operation, all factors considered, came with $\frac{3}{4}\times 0$-in. slack coal and double-screened coal of about $\frac{3}{4}\times\frac{1}{8}$ in. Although requiring closer operating attention to maintain proper distribution, 3x0-in. coal has been burned with no noticeable reduction in performance. There has been no appreciable burning of stoker parts.

Tests of the performance of the stoker control system revealed ability to bring unit from live bank (boiler at line pressure, steam output practically zero) to full load of 43,000 lb per hr on full automatic control, maintaining preselected fuel-air ratio for each load carried.

Evaporation Tests. A series of evaporation tests measured over-all unit performance. Coal was weighed manually to determine input. A steam-flow meter, carefully checked in accord with ASME Code, and continuously checked with and corrected to a mercury manometer, measured output. Table below summarizes test performance. Data represent weighted averages of two tests at each load indicated.

Air-flow data at end of table are significant in reference to basic principle of operation. At moderate combustion rates, air flow to link grate must be kept high enough to avoid clinker formation. At higher rates, with greater air flow, this air, in percentage of the theoretical requirements, becomes less, without causing clinker formation. Hence, fly-carbon losses do not increase as rapidly with load increase as they probably would if air flow through the grate increased in proportion to load.

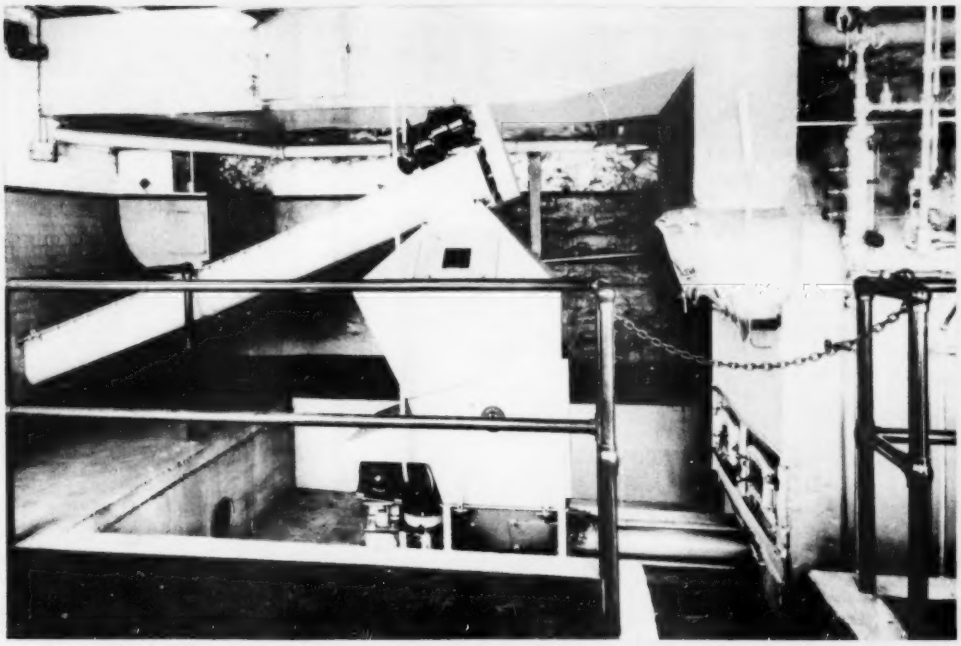
Available load and draft capacity limited maximum load to about 43,000 lb per hr. Thus limit of fuel-burning capacity has not been reached. Operating experience indicates it is considerably higher than any rate during the test period.

SUMMARY OF PERFORMANCE TESTS

Load (average of tests), 1000 lb steam/hr	15,090	28,500	40,650
Heat release, sq ft grate/hr, 1000 Btu	176	334	459
Heat release/cu ft furnace/hr, 1000 Btu	14.4	27.3	37.5
Number of tests	2	2	2
Total duration, hr	15.8	16.1	15.8
Steam generated/lb coal as fired, lb	9.62	9.72	10.14
Steam pressure, at meter, psig	116	123	137
Feedwater temperature, F	212	213	209
Heat added above feedwater, Btu per lb	1010	1011	1016
Fuel Analysis, as Fired:			
Moisture, %	7.1	5.4	5.4
Volatile matter, %	33.2	33.0	32.5
Fixed carbon, %	49.7	49.5	51.3
Ash, %	10.0	12.1	10.8
Sulphur, %	2.1	2.6	2.0
Heating value, Btu per lb	12,136	12,341	12,371
Ash-fusion temperature (two samples), F	2260	2360	2390
	2480	2370	2430
Coal passing 5/32-in. dia screen, %	9.7	28.9	21.6
Temperature of gas leaving boiler, F	408	495	547
Temperature of air entering fans, F	85	91	100
Flue-Gas Analysis, Boiler Outlet:			
CO_2, %	11.2	12.4	13.6
O_2, %	8.0	6.6	5.6
CO, %	0	0	0

Load (average of tests), 1000 lb steam/hr	15,090	28,500	40,650
Heat Balance:			
Heat absorbed in steam generated, %	80.0	79.7	83.2
Heat loss from moisture in coal, %	0.7	0.5	0.5
Heat loss from hydrogen in coal, %	3.9	4.1	4.1
Heat loss in dry flue gas, %	9.6	10.6	10.9
Heat loss in unburned CO	0.0	0.0	0.0
Heat loss in carbon to ashpit and stack, %	1.6	2.6	2.9
Radiation and unaccounted-for, %	4.2	2.5	−1.6
Total, %	100.0	100.0	100.0
Probable actual loss in radiation and moisture in air, %	2.7	1.5	1.1
Probable actual efficiency, corrected to this loss, %	81.5	80.7	80.5
Air Flow:			
Total air based on gas analysis, % of theoretical air*	163	147	134
Primary air, % of total air	69	78	81
Secondary air, % of total air	31	22	19
Air to link grate, % of total air	62	67	64
Air to link grate, % of theoretical air	101	98	86
Air to ash-discharge grates, % of theoretical	12	16	22
Secondary air, % of theoretical air	50	33	26

*Amount of air theoretically required to burn total fuel supplied at zero excess air



How to Cut Small Boiler-Plant Costs By Mechanical Coal and Ash Handling

Suggested layouts for plants of various sizes show how to do the job for best results; careful estimates of investment and operating cost of the different methods reveal the savings

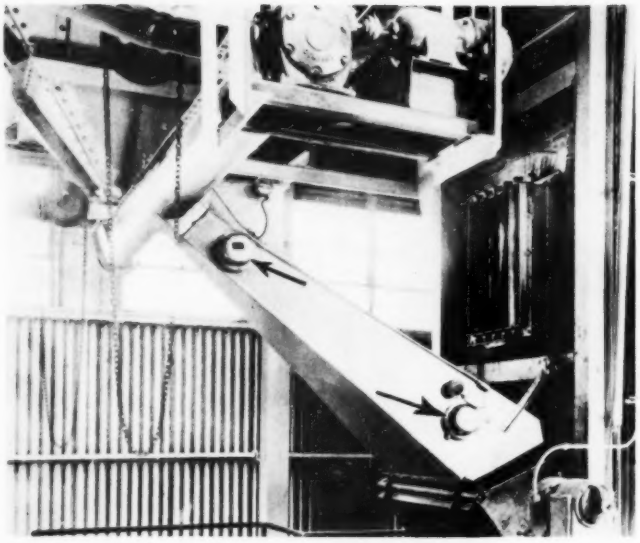
Nowhere can modern methods bring greater benefits than in small boiler plants, yet nowhere are they less used. Small coal-fired plants burn almost 10% of total U. S. coal production — about 60 million tons per year. This coal has to be moved into and around the plants, and resulting ash must be removed. Too often, the old way—men plus shovels and wheelbarrows — still persists, dirty and expensive.

Yet for even the smallest plants, there is mechanical equipment to handle coal and ash better and cheaper. Less labor is required; operators have time to work on plant maintenance and improvement. Eliminating dust and dirt boosts morale by doing away with the drudgery.

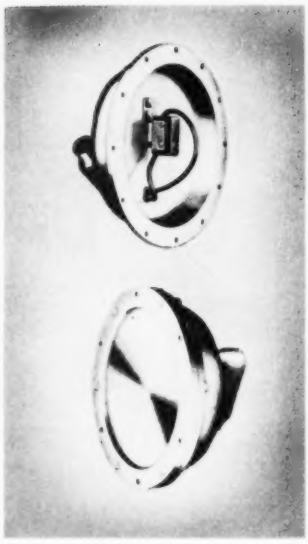
Of many benefits from mechanized handling, dollar saving probably looms largest to cost-conscious management. Properly chosen equipment cuts operating cost enough to return the investment in a few years. Best of all, savings continue for the plant's life.

What does modern handling equipment cost? Exactly how much can it save? What type should be chosen and how should it be installed? Here, for the first time, are answers to these and similar questions. They result from a detailed engineering study by C E Miller, H M Carlson and R B Engdahl, Battelle Memorial Institute. It is one of a number of studies being conducted for Bituminous Coal Research, Inc, to improve the small coal-fired plant.

POWER · FEBRUARY 1949 · P W SWAIN, EDITOR



AUTOMATIC SWITCHES located in the coal chute, as shown above, start and stop the conveyor motor in accordance with the stoker's needs, keeping the hopper full



DETAIL OF SWITCHES used in coal chute at left reveals the details of construction

Even plants burning only a few tons of coal each week have a choice of equipment from which to put together a mechanical coal-and-ash-handling system that pays dividends. What arrangement proves best depends on a number of things—for example, plant size and location, and whether boiler room is above, below or at ground level. Then there is the matter of coal deliveries. Are they made by truck or by rail? And how regularly—since frequent deliveries mean less need for storage? Naturally, adapting equipment to an existing plant presents some features different from those of a new plant.

Nature of Load. Equipment selection also depends on kind of load served. Plants supplying steam on a year-round basis to laundries, hospitals, factories should be fairly complete and practically automatic. Longer operating hours of these plants will produce savings large enough to pay for such comprehensive installations in a relatively short time. On the other hand, for plants supplying steam during the heating season only to buildings, such as apartment houses and hotels, equipment may be less complete owing to the smaller tonnage handled, and it will, therefore, be less costly.

A complete discussion of all these factors, and all types of equipment available, would require a book. Fortunately, practical needs of plant managers and engineers can be met more simply, and so the following pages answer the basic questions—What? How? How Much? Since a well-designed system costs no more in the long run than a makeshift one, these pages show:

1. *Some typical well-designed installations* that are low in cost and specifically adaptable to the small boiler-plant field.

2. *Costs of these typical arrangements,* including conveying equipment.

3. *Typical reductions in operating cost* that may be effected through lowered costs of fuel and labor.

For convenience in finding those designs that most nearly meet any particular set of conditions, the suggested layouts are divided into five groups according to boiler rating: 30, 90, 150, 225 and 300 hp*. Coal and ash-handling equipment shown and discussed in the following pages includes: screw, bucket, mass and apron-type-feeder conveyors, simple ash hoists and pneumatic ash-handling apparatus. Table on facing page lists typical manufacturers of such equipment, from whom further details may be obtained.

Since a great many small plants normally include only one boiler or operate only one unit at a time, this study is based on a one-boiler plant. In plants where more than one unit is installed or needed, minor modifications fit the single-unit layout to the new conditions.

Before turning to specific examples, certain general features of modern design for small boiler plants warrant brief discussion:

Labor Cost. Small coal-and-ash conveyors form the chief means of eliminating hand labor. They get rid of labor not only for cleanup but also for filling coal hoppers; this work can be accomplished by simple electric controls on the automatic stoker. Other automatic features should be incorporated in a small boiler plant to avoid need for frequent attention, as follows: (1) low-water-alarm cutoff or similar device to prevent equipment damage, and (2) automatic combustion controls to vary burning rate in accordance with load demands. Then, all that is required of plant labor is to check the equipment periodically and at that time to remove ashes from the stoker.

Photo on page 91 shows a neatly arranged small boiler plant that for ten years has been drawing dividends from the advantages of modern equipment. The photographs above illustrate a typical example of automatic switches for starting and stopping conveyors according to stoker needs.

Fuel Costs. Coal is, and from present indications will continue to be, the most widely used fuel in many U.S. industrial areas. Efficient plants to

*The term "horsepower" is admittedly a poor measure of boiler capacity and progressive authorities fight for its replacement with a more accurate term. We agree fully. With apologies, we use the term here because most small boilers are still rated in horsepower and no other term so well serves the present purpose of quickly identifying broad size groups.

utilize this economical fuel necessarily appeal to management from the long-range point of view, especially in the light of vast coal reserves.

Safety and Cleanliness. A dust-tight permanent partition between coal-storage space and the boiler room eliminates dust and dirt from trucks or coal cars. Closed conveyors move coal from bin to stoker grate without dust. Covered containers for ash and clinker greatly reduce ash dust in very small plants; in larger ones, enclosed ash-handling systems are indicated.

Note that all layouts show a sloping self-cleaning coal bin. This avoids dead storage and the possibility of spontaneous combustion. In many areas where coal is of good storing quality, the bin may be left with a flat bottom to use space better.

Why Not More? Considering all the advantages of these improved designs, it is natural to ask, "Why haven't such improvements been incorporated in more plants, long before now?" There are a number of reasons for the delay and for the increasing application of improvements now. First, rising labor costs continue to make it easier to justify spending money for automatic equipment. Second, most workmen now expect to be provided with automatic machinery to do work they were formerly satisfied to do by hand.

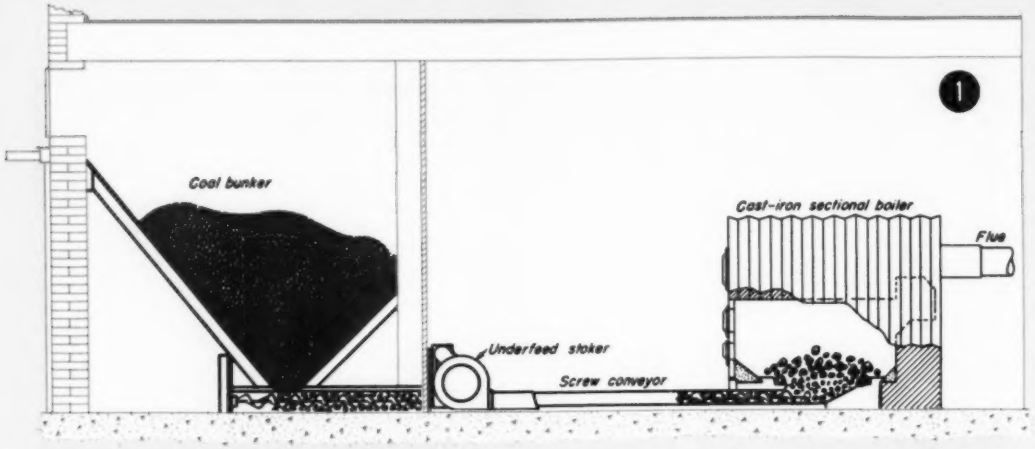
The third reason goes back to the way most small plants are usually designed. Layout of the small boiler plant too often is incidental to the building of a hotel, laundry or factory, and is not given the attention it deserves. Not being a specialist in the boiler-house field, the architect or engineer tends to overlook many devices available for improving plant efficiency and lowering operating cost. Finally, it has taken time for the development of handling equipment suited to the small plant.

Cost Comparisons. The following discussion of various suggested layouts, includes certain investment and operating costs. For simplicity, only summaries are given. Those who want more detailed information may secure the appendix to this report from the Bituminous Coal Research, Inc., Pittsburgh, Pa. It includes: (1) fuel costs (2) general calculations (3) investment and operating costs for low-pressure plants supplying heating only, and (4) investment and operating costs for year-round 100-psi plants.

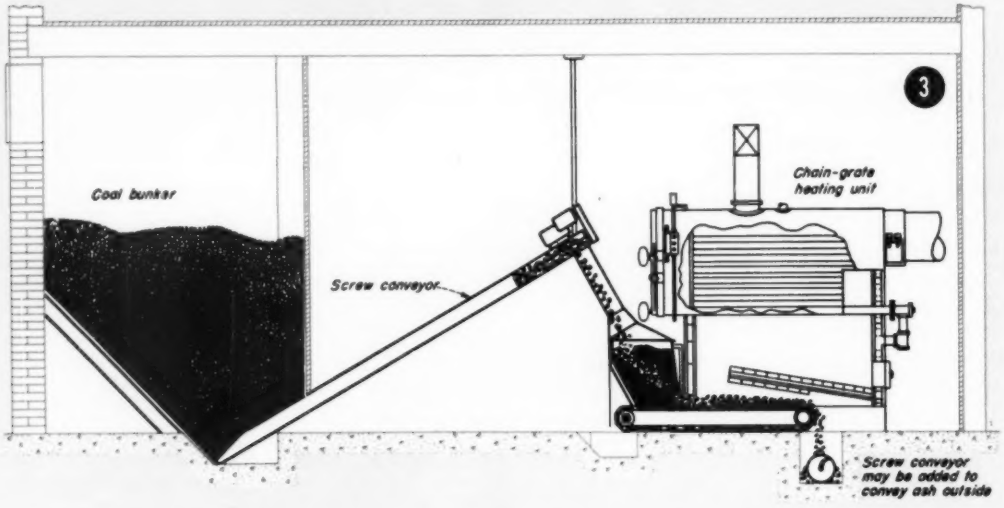
Classified List of Typical Manufacturers of Coal- and Ash-Handling Equipment

Manufacturer	Belt conveyor, large	Mass-flow conveyor	Bucket conveyor and elevator	Screw conveyor	Belt-conveyor light, portable	Drag-link conveyor	Overhead track and trolley	Steel or iron bunkers	Storage silos	Pneumatic ash conveyors
Allen-Sherman-Hoff Co 225 S 15th St Philadelphia 2, Pa.										■
C O Bartlett & Snow Co 6200 Harvard Ave Cleveland 5, Ohio	■		■	■		■				
Beaumont-Birch Co 1305 Race St Philadelphia 2, Pa.	■	■	■	■		■		■	■	■
Chain Belt Co 1600 W Bruce St Milwaukee 4, Wis.	■		■			■				
The Fairfield Engrg Co 307 Bernhart St Marion, Ohio	■		■	■	■	■		■	■	
A B Farquhar Co York, Pa.	■				■	■				
Gifford-Wood Co Hudson, N. Y.	■		■	■		■	■	■	■	
Hahn-Pitz Corp 286 Scholes St Brooklyn 6, N. Y.								■	■	■
Hydro-Ash Corp 1408 W Harrison St Chicago 7, Ill.									■	■
The Jeffrey Mfg Co 956 N Fourth St Columbus 16, Ohio	■		■	■		■				
Joy Mfg Co Oliver Bldg Pittsburgh 22, Pa.	■				■	■				
Link-Belt Co 307 N Michigan Ave Chicago 1, Ill.	■	■	■	■	■	■	■	■	■	
The Louden Machinery Co. Fairfield, Iowa							■			
D J Murray Mfg Co Wausau, Wis.	■		■	■	■	■				
The Nicholson Co, Inc* 10 Rockefeller Plaza New York, N. Y.									■	
Robins Conveyor Div 270 Passaic Ave Passaic, N. J.	■		■							
Stephens-Adamson Mfg Co 5 Ridgeway Ave Aurora, Ill.	■	■	■	■	■	■	■		■	
United Conveyor Corp 1295 Old Colony Bldg Chicago, Ill.									■	■

*Designs and installs complete coal- and ash-handling systems under single responsibility.



BIN-FEED STOKER Direct feed from the bin usually works well for a new installation or for a hand-fired plant that is to be modernized. Bin-feed stoker for 30-hp boiler above costs about $1900 installed



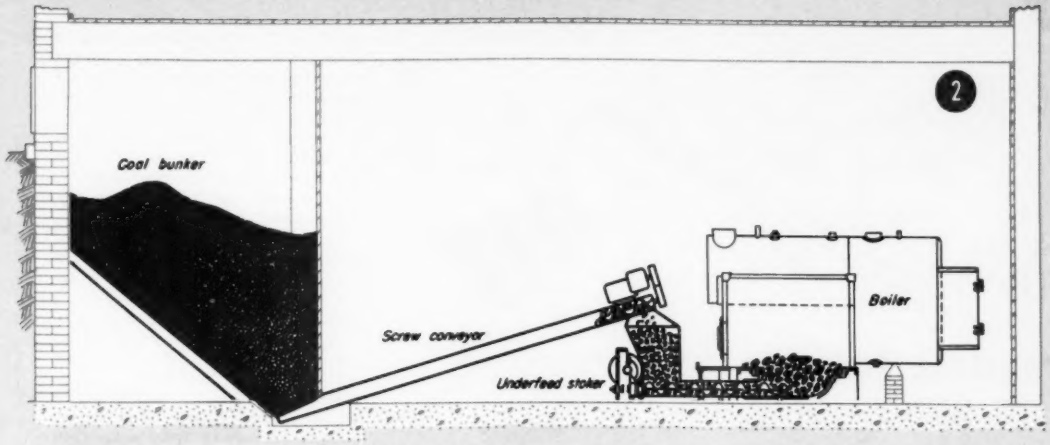
CHAIN GRATE, CONVEYOR For areas where free-burning coals are available, a chain-grate stoker suits. Conveyor adds about $750 to the $6000 cost for the stoker and 90-hp boiler

Layouts and Costs for 30-90-hp Plants

Typical improved layouts for 30-hp plants are shown in Fig. 1 and 2, above. These illustrate arrangements suitable for such service as supplying heating steam for small apartment buildings and hotels, or process steam on a year-round basis for small industrial plants, laundries and dairies.

Fig. 1 shows the arrangement usually found most satisfactory and lowest in cost for a new installation, or for an existing hand-fired plant to be modernized with a stoker. Bin-feed stokers, of the type shown, can ordinarily be installed for less than $2000, effecting savings in operating expense by cutting labor costs and improving fuel utilization—savings that pay off the investment in about one year.

Fig. 2 shows the setup that proves best where a hopper stoker is already installed, or where some local condition indicates that this type is desirable. For a hand-fired boiler, an installation of this kind can be made for about $2400, as compared with about $1900 for the bin feed. The stoker itself



HOPPER STOKER, CONVEYOR

For a 30-hp 100-psi boiler, hopper stoker costs about $1600 installed. Conveyor to mechanize coal handling adds about $750 to cost

TABLE I: ESTIMATED COSTS OF OPERATION FOR 30- AND 90-HP PLANTS

Low-pressure plant, heating load only	30 hp				90 hp				
Type of Installation	Hand-fired	Hopper stoker without conveyor	Hopper stoker with conveyor	Bin-feed stoker	Hand-fired	Hopper stoker without conveyor	Hopper stoker with conveyor	Bin-feed stoker	Chain-grate stoker with conveyor
Investment in boiler plant	$2,960	$4,450	$5,200	$4,750	$6,170	$8,150	$8,900	$9,350	$9,250
Operating costs, per year									
Fuel	$ 640	$ 540	$ 540	$ 540	$1,920	$1,630	$1,630	$1,630	$1,630
Other operation	2,030	440	280	280	4,200	1,300	980	980	980
Total	$2,670	$ 980	$ 820	$ 820	$6,120	$2,930	$2,610	$2,610	$2,610
100 psi, year-round operation									
Investment in boiler plant	$5,170	$6,650	$7,400	$6,950	$8,290	$10,450	$11,700*	$12,150*	—
Operating costs, per year									
Fuel	$2,890	$2,440	$2,440	$2,440	$6,940	$5,870	$5,870	$5,870	—
Other operation	3,320	1,430	980	980	5,920	3,380	2,930	2,930	—
Total	$6,210	$3,870	$3,420	$3,420	$12,860	$9,250	$8,800	$8,800	—

*Includes manually operated ash hoist, which costs about $500. Note: Prices as of March 1948. Fuel price for 30-hp plants and 90-hp low-pressure plants is $11.10 per ton for coal. Fuel price for 90-hp 100-psi plants is $8.90 per ton.

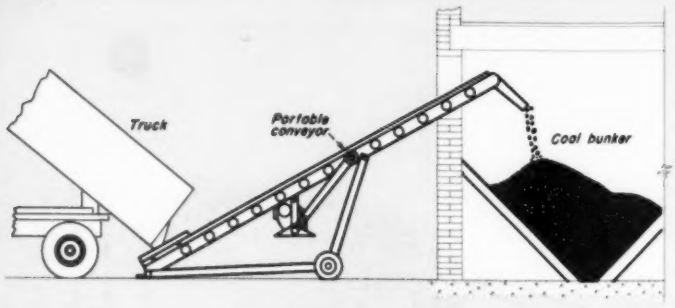
is slightly less expensive, but the coal conveyor costs about $750 installed, which brings the over-all cost to the higher total. In plants already operating a hopper stoker, installation of a $750 coal conveyor will save about $150 to $450 per year in labor, which makes it economically justified.

In the 30-hp plant, mechanical ash removal is not normally justified, as the amount handled will come to only about 5 to 20 tons per year. This can ordinarily be removed by hand in the operator's regular tour of duty. By using suitable closed containers, ash can be taken out without seriously affecting plant cleanliness.

Typical boiler-room layouts for 90-hp plants closely resemble those for 30-hp, and the layouts of Fig. 1 and 2 will apply. In many areas where free-burning coals are available, the small chain-grate stoker proves well suited to low-pressure heating service. Fig. 3 shows a suggested layout. The chain grate enjoys the advantage of being a partial package-type unit with simple ash-removal arrangements. As shown, a screw conveyor may be added to remove the ash discharged from the moving grate.

In the 90-hp plants, amount of ash to remove varies from about 15 tons per year in lightly loaded heating plants to about 65 tons per year in high-pressure year-round plants. On below-ground installations, when this heavier tonnage of ash must be handled, investment in a small hand hoist, as illustrated later in Fig. 6, is often justified. Investment cost figures for the high-pressure 90-hp plants of

4



PORTABLE CONVEYOR **To lift coal to ground-level bunker, portable elevator costs about $1000**

Table I include about $500 for such equipment.

Table I summarizes investment and operating costs for the 30- and 90-hp plants. Fuel costs for both low-pressure heating operation and 100-psi year-round operation of the 30-hp plants, and for low-pressure operation of the 90-hp plants, are based on prepared coal at $11.10 per ton. For 100-psi operation of the 90-hp plants, an industrial stoker coal at $8.90 per ton is used. These are approximate average prices of coal purchased in the eastern United States. Allowance can be made for local variations. The same price for industrial stoker coal is used in all subsequent tables.

The operating labor, shown in this and following cost comparisons, is represented by the estimated amount of time required in actual operation by the plant man assigned to this responsibility. It is assumed that management will arrange proper schedules so all the time of men assigned to boiler-room operation will be productive.

Estimates of fuel use and hours of operation are based on study of hundreds of small plants. For heating service only, the operating basis was taken as 16 hr per day, 210 days per year at an average rating of about 25% of normal boiler rating. For the high-pressure plant, the operating basis was predicated on 12 hr per day, 300 days per year, at an average of 100% of normal boiler rating.

Cost difference between a modern coal-fired plant—with stoker and mechanical coal conveying—and a completely unmechanized hand-fired plant runs from $1800 to $3400, depending on plant size and equipment type. But the annual savings in fuel and labor are of about the same order, enough to pay for the added investment in about one year's time. The improvement in plant appearance and freedom from dust and dirt are extra dividends from an investment already justified by purely economical advantages.

It can be seen that for both 30- and 90-hp plants there is little difference between the hopper and bin-feed stokers; on an original design, however, it usually proves possible to work out a better equipment arrangement with the bin-feed installation, even though first cost may be slightly higher.

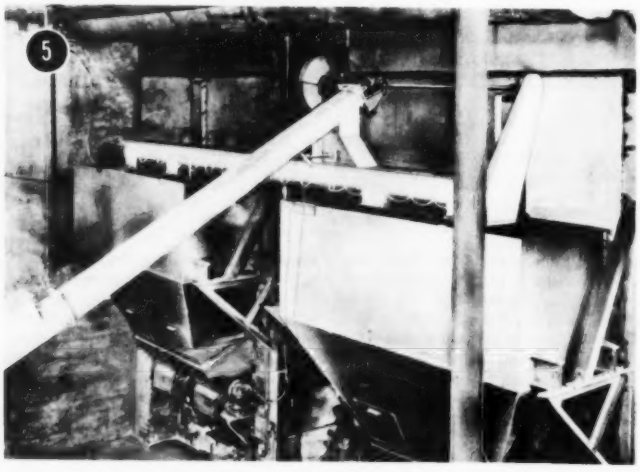
Regardless of the fuel-handling method selected, total plant investment charges will necessarily be higher than for hand-firing, but the additional capital outlay is actually small in comparison to that for boilers, piping, etc. and erection.

Also the investment pays off through savings in operating expenses from more efficient plant operation. Savings effected by automatic firing are least for heating installations where fuel consumption is low, but increase rapidly as heavier loads are carried, as in year-round plants.

In many plants, particularly in larger ones, the boiler room is at ground level rather than in a basement, as shown in the typical layouts. This requires that some provision be made to elevate the coal being delivered to the plant to a sufficient height in the plant bunker so the feed screw in the bunker bottom is always covered. One of the simplest methods, if enough space is available, is to provide a ramp so trucks can unload directly at the required level. In some areas, trucks are equipped with conveyors that perform this elevating operation. In other cases, some type of portable conveyor must be provided at the plant. Delivery trucks can then discharge directly onto this elevating conveyor, which delivers coal to the plant bunker, Fig. 4.

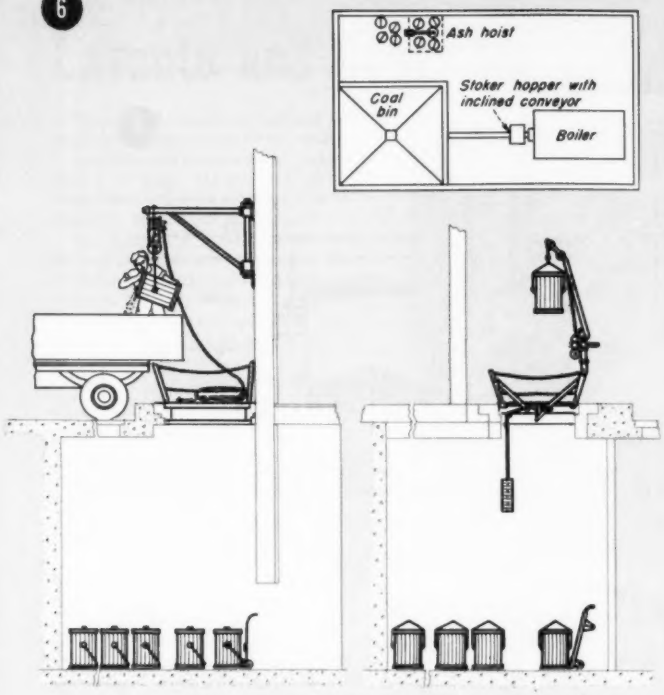
Fig. 5 illustrates the simplicity of applying these general conveying systems to plants having two or more boilers instead of the single units of Fig. 1-3. Although this illustration is referred to here in the discussion of plants in a specific size range, it is equally applicable to units of other sizes, as local conditions require. As shown, the arrangement merely consists of a screw conveyor feeding from the bunker to a reversed-flight conveyor mounted in front of the boilers. By means of a deflecting damper at the top of the elevating screw, coal can be delivered to either boiler or to both, as required.

5

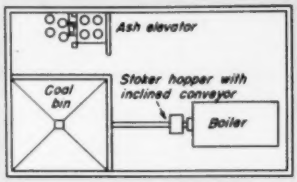


TWO-BOILER SETUP **Combination of two screw conveyors and a directing damper serves either boiler unit**

6



ASH HOISTS Simple bracket-type hoist costs about $500 installed; hoist combined with hatchway runs about $1000



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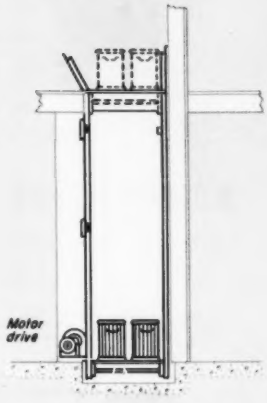


ELEVATOR Motor-driven elevator runs to $4000

Ash-Handling Methods for Basement Plants

In downtown metropolitan areas particularly, many plants in the 90-150-hp size range are located below ground level. In such plants some special provision must be made for ash removal where a convenient freight elevator is not available. As previously mentioned, several forms of hand hoists are available; Fig. 6, above, shows two widely used arrangements that do a good job.

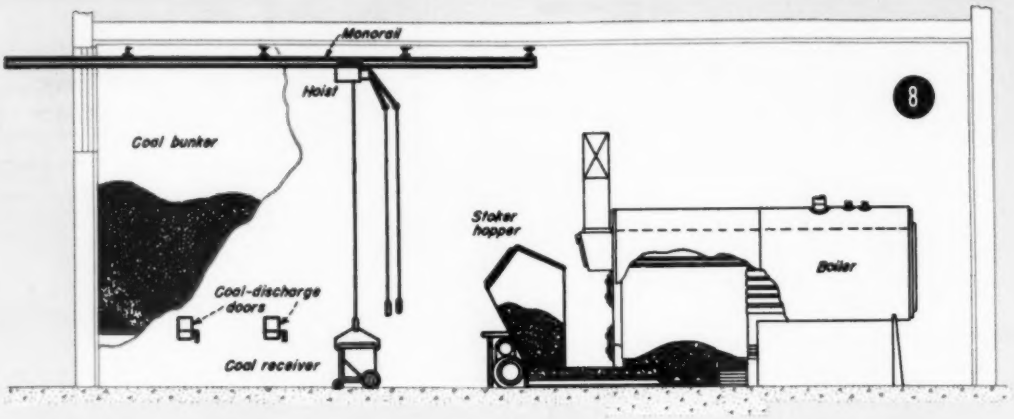
In both, ash goes into covered containers and is hand trucked from the boiler room to a storage space, from which it is taken at intervals by a hoist. As shown at the left, a simple bracket is mounted on the building wall, high enough so ash can be raised from the storage space in the basement, swung out, and dumped directly into an ash truck at street level. The hoist operates through a simple street-level hatchway or areaway.

In the scheme at the right of Fig. 6, hatch and hoist are combined so no external bracket is required. Such hoists prove quite satisfactory for handling ash in quantities up to about 2 tons per week. They can be installed for about $500 to $1000 complete, depending on size and arrangement. The scheme at the right, with hoist and hatch combined, is usually the more expensive of the two.

Where larger quantities of ash are involved, an elevator handles the job more quickly and effectively. Fig. 7 shows a typical arrangement, with a small platform elevator working through a hatchway at street level. The elevator is motor driven. For dumping cans into a truck, a hoist may be provided, not unlike that shown at the left of Fig. 6. If cans are not too large, they may, of course, be lifted to the truck by hand. Such an elevator can be installed at a cost of about $4000. Cost varies with height of shaftway.

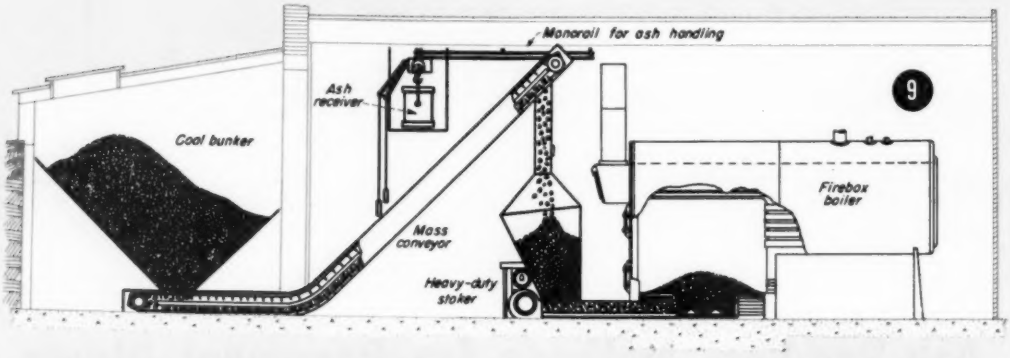
Regardless of the method used to bring the ash to street level, there are several general points that should always receive consideration. If the job is to be handled with a minimum of dust and nuisance, covered containers must be used. Cans should be sturdy enough to stand up under the relatively hard use likely to be met.

In this kind of operation, loading cans and moving them out of the boiler room is easy and quick, and can be readily carried out in the operator's regular tour of duty. Lifting them to street level consumes more time, and requires the operator to leave the boiler room for a substantial interval. If it is at all possible, ample storage space for ash cans should be provided so lifting and dumping operations occur as infrequently as possible.



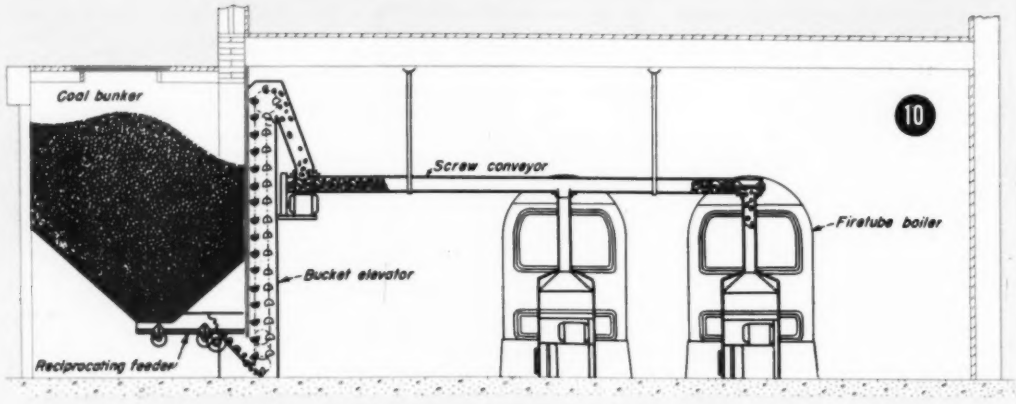
MONORAIL FOR COAL, ASH

One bucket serves for coal and ash. Stoker for a 150-hp low-pressure boiler costs about $2500 installed; bucket and monorail about $2000



MASS CONVEYOR, MONORAIL

Conveyor to carry coal to stoker costs about $3100 installed. The ash monorail adds about $1000 to investment. The stoker is same as above



BUCKET ELEVATOR, SCREW CONVEYOR

Reciprocating feeder, bucket elevator and screw conveyor to serve two boilers costs about $4000

Layouts and Costs for 150-hp Plants

For larger tonnages of coal and ash, more completely mechanized handling is desirable and economically justified. Fig. 8-11 show layouts for 150-hp plants that will, with only minor modifications, serve even larger units.

Fig. 8 shows a simple system employing the relatively inexpensive and flexible monorail for handling both coal and ash. While the monorail is readily adaptable to a wide variety of plant layouts, it serves best where coal is damp or dustproofed.

Note that the bunker has a sloping bottom and doors so the bucket can be filled directly from the bin without hand shoveling. Wheels on the bucket allow it to be pushed to the boiler front where ash can be moved from grate to bucket with minimum manual labor. Taking the ash outside the plant on the monorail is a simple operation.

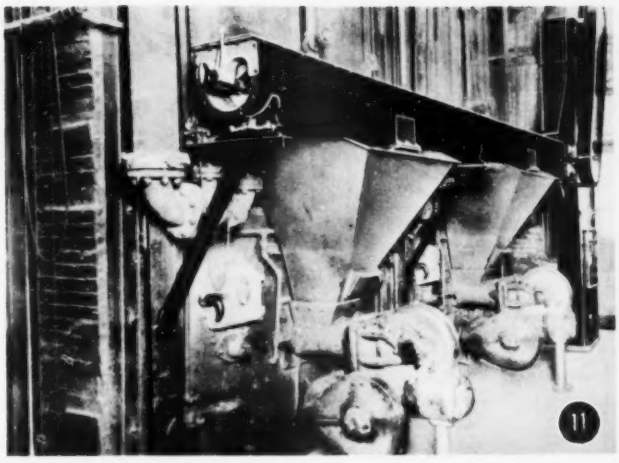
Fig. 9 shows a mass-type conveyor, consisting of an enclosed casing through which conveying flights travel. Coal moves upward or forward with the flights, in a solid column. Such a conveyor is dustless and flexible in application. It can be loaded or unloaded at any point and take slight changes in direction. Wear on the casing may prove a major factor, particularly where there is a change in direction. For this reason, casing must have proper wear-resisting qualities.

Automatic start-stop switches are provided on the stoker hopper, which has been extended. This yields better operation by insuring a greater reserve of coal over the stoker ram at all times, and reduces conveyor wear by lengthening period of operation and decreasing number of starts and stops.

For direct lifts from an underground bunker to boilers at a higher level, bucket elevators prove suitable, combined with a screw conveyor. Fig. 11 shows such a combination supplying coal from below to two boilers, while Fig. 10 shows a layout for boilers on the bunker-floor level. Cost of the two conveyors in this combination is slightly more than that of a single unit, but the combination can serve in some places where a single unit cannot.

Many boiler plants in this size range are below ground level. For ash removal in such plants, several suitable arrangements are shown on p 7.

Table II summarizes the investment and operating costs of typical plants in the 150-hp class. Investment cost for the stoker plant with conveyor includes ash-removal equipment in the year-round estimates, but not in the heating-load estimates.



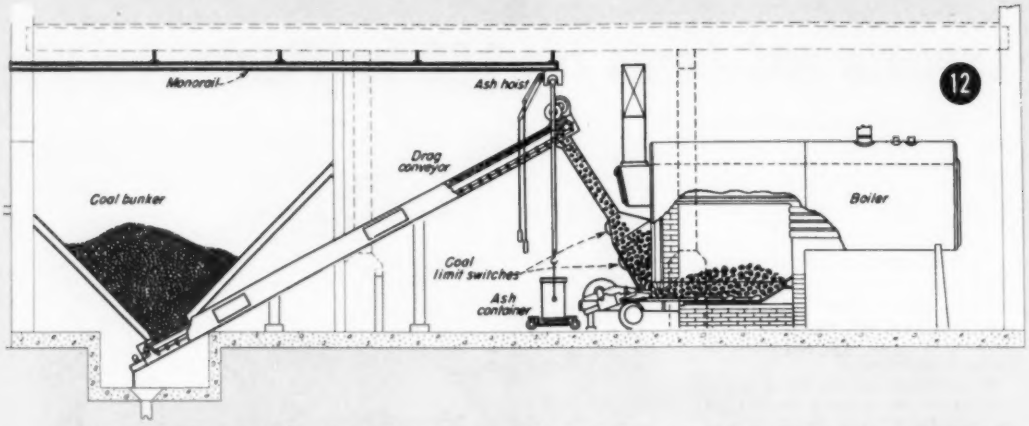
BUCKET ELEVATOR Here bucket elevator lifts coal from basement bunker, screw conveyor feeds two units

It is interesting to compare the investment and operating costs for both heating-season and year-round plants in Table II. For the low-pressure heating plant investing about $2200 for a hopper stoker saves about $3700 a year in operating expenses. Consider the 100-psi year-round plant: Operation with hand firing costs $20,130 a year. Adding a $2200 stoker to a $12,400 investment saves $4990 a year. When mechanized handling of coal is added to the picture, further operating savings result – about $630 per year for heating-season operation and $900 per year for 100-psi operation. With added investment for conveying equipment coming to $2000 and $4350, respectively, savings pay off the cost in about three to five years, without allowance for decreased cleaning costs, better morale, and other valuable gains.

Table II: Estimated Costs of Operation for 150-Hp Plants

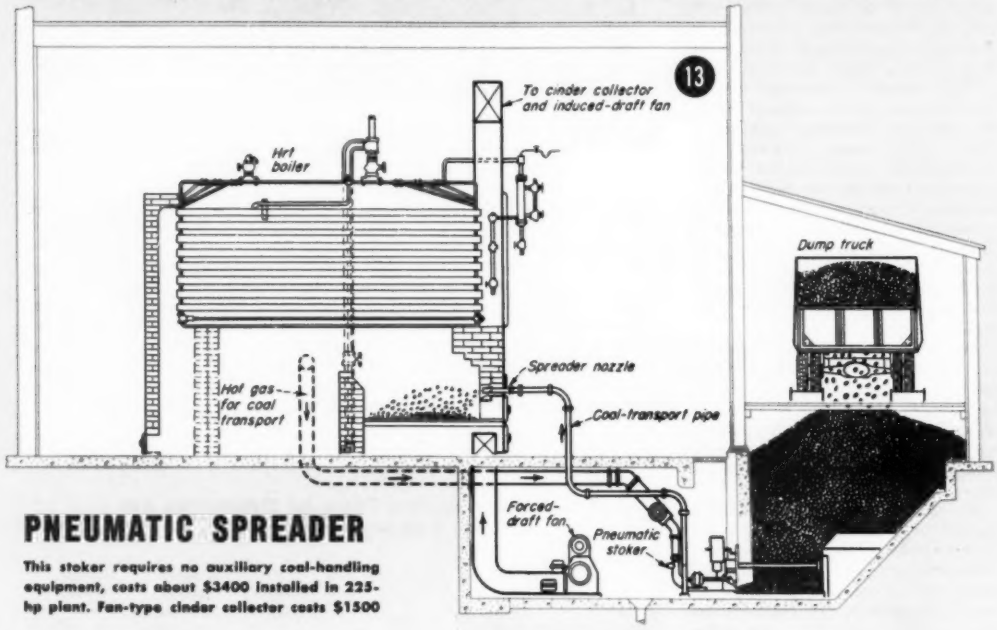
Low-pressure plant, heating load only **Type of installation**	**Hand-fired**	**Hopper-stoker without conveyor**	**Hopper-stoker with conveyor**
Investment in boiler plant	**$9,500**	**$11,720**	**$13,720**
Operating costs, per year			
Fuel	**$2,580**	**$ 2,180**	**$ 2,180**
Other operation	**5,740**	**2,480**	**1,850**
Total	**$8,320**	**$ 4,660**	**$ 4,030**
100 psi, year-round operation			
Investment in boiler plant	**$12,400**	**$14,630**	**$18,980***
Operating costs, per year			
Fuel	**$11,600**	**$ 9,800**	**$ 9,800**
Other operation	**8,530**	**5,340**	**4,440**
Total	**$20,130**	**$15,140**	**$14,240**

*Includes $1350 to handle ashes for bucket and monorail system. Note: Prices as of March 1948. Fuel price is $8.90 per ton for industrial stoker coal.



DRAG CONVEYOR, MONORAIL

In 225-hp high-pressure plant, drag conveyor to serve ram-type underfeed stoker costs $3500 installed; monorail, bucket, about $1500



PNEUMATIC SPREADER

This stoker requires no auxiliary coal-handling equipment, costs about $3400 installed in 225-hp plant. Fan-type cinder collector costs $1500

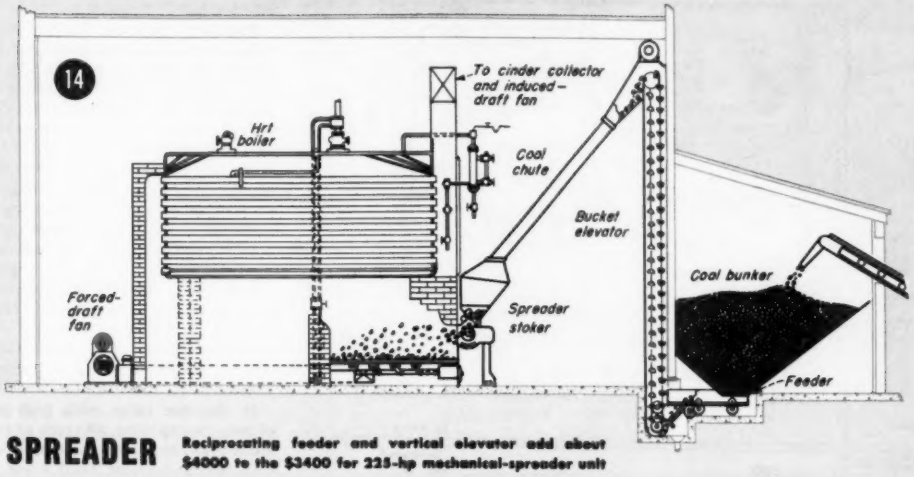
TABLE III: ESTIMATED COSTS OF OPERATION FOR 225- AND 300-HP PLANTS

100 psi, year-round operation

Type of installation	225 hp				300 hp	
	Hand-fired	Hopper stoker without conveyor	Hopper stoker with conveyor	Pneumatic-spreader stoker	Hopper stoker without conveyor	Hopper stoker with overhead bunker
Investment in boiler plant	$15,900	$18,550	$23,550*	$20,450 ($12,000 additional if pneumatic ash handling used)	$39,600	$49,600*
Operating costs, per year						
Fuel	$17,400	$14,700	$14,700	$14,700	$19,600	$19,600
Other operation	10,090	7,960	6,660	6,810	16,080	10,680
Total	$27,490	$22,660	$21,360	$21,510	$35,680	$30,280

*Includes mechanical ash-handling equipment.

Note: Prices as of March 1948. Fuel price is $8.90 per ton for coal.



SPREADER Reciprocating feeder and vertical elevator add about $4000 to the $3400 for 225-hp mechanical-spreader unit

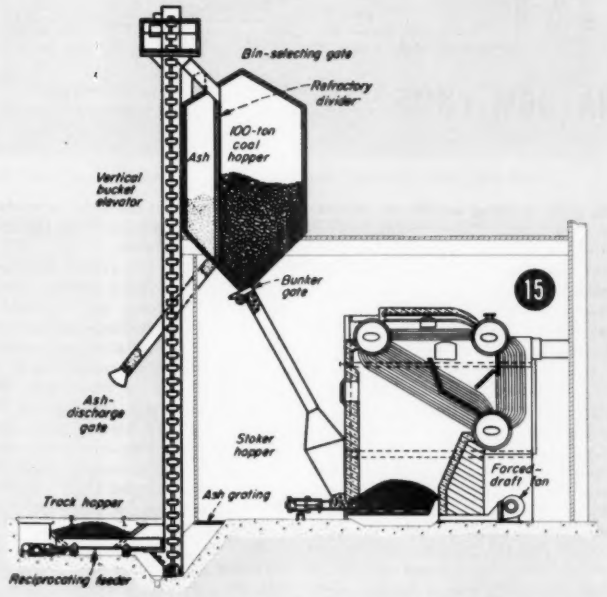
Layouts and Costs for 225-300-hp Plants

Fig. 12-14 show suggested arrangements for typical plants in the 225-hp size range. In the underfeed-stoker plant of Fig. 12, a drag conveyor moves coal from bunker to stoker hopper, and a monorail handles ash. In this and larger plants, quantity of ash handled justifies a motor-operated hoist for the monorail bucket.

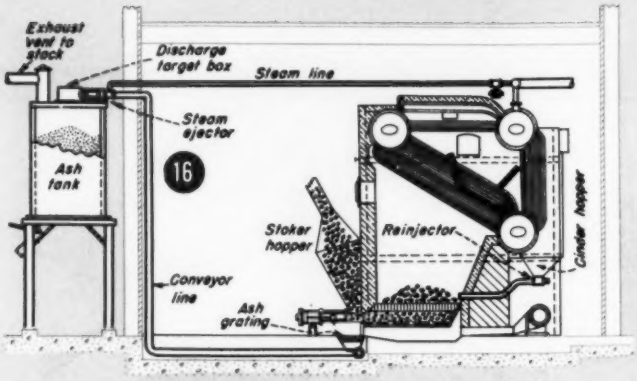
Fig. 13 shows a typical pneumatic spreader stoker, which eliminates need for special coal-conveying equipment between boiler and bunker. The commonly used mechanical spreader stoker can be adapted equally well to this general layout by the simple addition of a bucket elevator for raising the coal high enough to be dropped through a chute to the stoker hopper, Fig. 14.

Cost estimates for the spreader-stoker layouts include an induced-draft fan and cinder collector. Although many localities do not yet require such a refinement, it is considered good practice always to install some form of cinder collector.

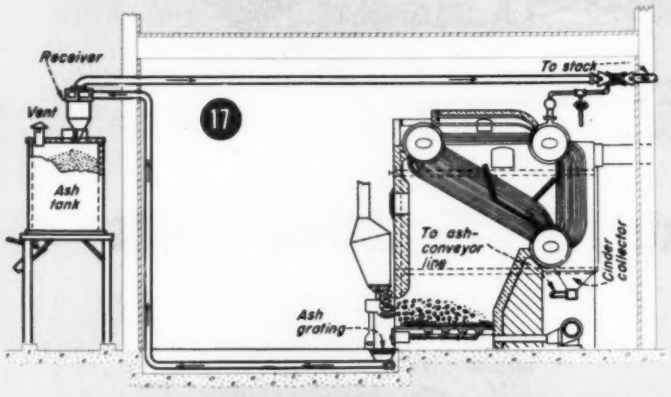
Fig. 15 shows a 300-hp plant with overhead bin for coal storage. This is considered one of the most desirable layouts, showing low maintenance costs because of the simple gravity feed from bin to stoker. Since such a layout is more costly, however, it can be justified only for larger plants. Having part of the storage bin inside



OVERHEAD BIN Conveyor system and storage bin for both coal and ash costs about $15,000 for 300-hp boiler



STEAM JET This simple pneumatic ash-handling system mixes the ash with steam, costs approximately $7000 installed



VACUUM PUMP This system handles ash dry, an advantage in some cases. Cost is about $12,000 installed

the plant building avoids the problem of frozen coal. Closed chutes between bunker and stoker insure a clean plant and a continuous fuel supply regardless of boiler load swings. The layout shown is arranged for unloading hopper-bottom railroad cars; it serves equally well for unloading trucks.

It is important to choose a type of feeder adapted to local conditions of topography and fuel deliveries. Usually the type that requires least excavation, and will do the job, can be installed at least cost. Pit for the feeder and hopper should have adequate drains and a unit heater to keep feeder and elevator warm in winter.

Note that the same elevator is used for handling both ash and coal. To reduce cost still further, a dividing partition in the overhead bunker makes it serve for ash and coal. Separate elevators and bins are, naturally, more costly, but they have the added advantage of keeping coal and ash entirely separated from each other.

For plants in this general size range (225 hp and up), there are many methods of ash removal. At one extreme, the operator merely wheels the ash out of the plant to a dump about once every 8 hours. For the basement plant, the elevator of Fig. 7 is commonly used. Other arrangements are shown in Fig. 12 and 15. Often, especially in plants amortized on a long-term basis, dust-free and nearly automatic pneumatic systems prove justified. These cost about $7000 if actuated by steam jets, and about $12,000 if by vacuum pump.

Fig. 16 shows a steam-jet system, in which steam mixes with, and moistens, the ash. This works well with the underfeed-stoker type of ash. For fine ash, as from a spreader stoker, the moist mixture may prove difficult to remove from the bin. Fig. 17 shows a vacuum-pump system for handling ash dry, except for wetting when loading into trucks.

Pneumatic systems offer the advantages of maximum cleanliness and simplicity of working parts. Large clinkers must be broken up before feeding into the system; this is done on a bar screen over the inlet ports. The steam ejector uses comparatively large amounts of steam so ash removal is usually handled in off-peak periods. Possibility of wet ash freezing can be reduced by (1) installing a steam coil around the bin bottom, and (2) removing ash from bin more frequently.

Table III summarizes investment and operating costs for the 225-hp and 300-hp plants on a 100-psi year-round basis. Note that pneumatic ash handling is figured separately for the pneumatic spreader stoker.

In this size range, with high rates of fuel consumption, all types of automatic coal-fired plants show operating-cost savings against hand firing. Increased savings from mechanized handling are great enough to pay off the additional investment in a period of less than one year to about three years, depending on plant conditions.

SUMMARY

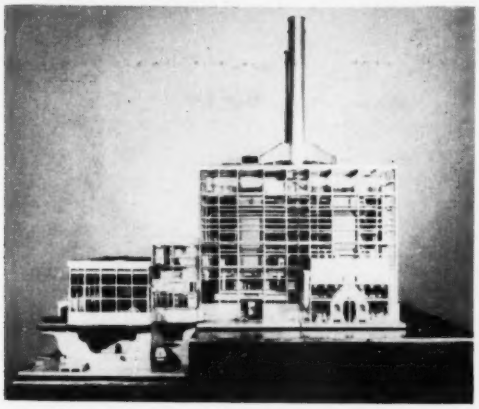
The foregoing layouts and cost estimates reveal two major facts: (1) Small coal-fired boiler plants, like their larger brothers, can be planned to cut labor cost to a minimum and, at the same time, provide clean, pleasant working conditions. (2) Properly designed automatic coal-fired plants in most coal-burning areas of the U.S. may show an actual saving to the consumer over competitive fuels.

Large reserves assure a coal supply for many years. Sound planning on a long-range basis requires that this factor be given serious consideration in designing new plants and modernizing old ones. Combustion equipment should be selected to assure fuel flexibility—ability to use coal efficiently in sizes and qualities economically available, now and in the future, in the plant's supply area.

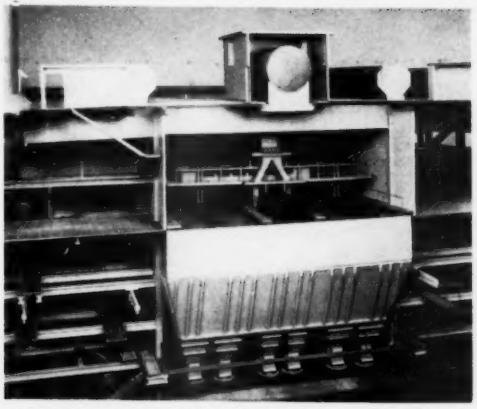
It is equally important that adequate provision be made for coal and ash handling. The trend is away from manual handling and toward mechanization. Industrial progress requires the low operating costs, clean working conditions, and high morale that accompany the installation of mechanical equipment.

We face a new era in design and operation of small boiler plants. Let's apply to them the "big-plant thinking" that has paid dividends in central stations and large industrials.

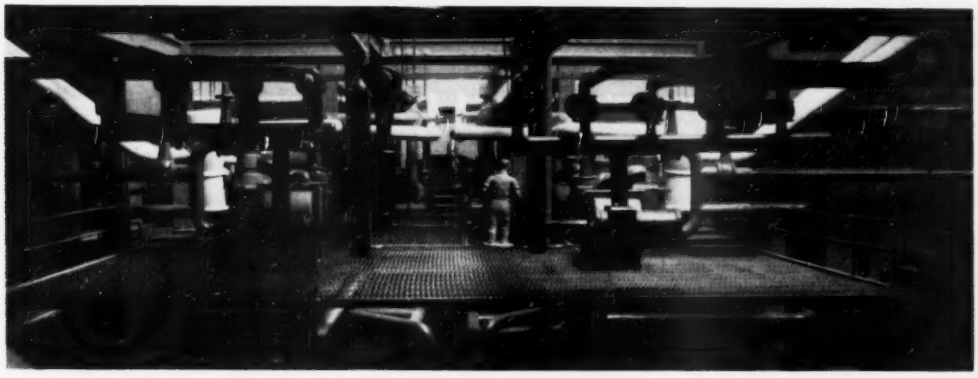
SUNBURY STATION MODEL CONTINUED FROM PAGE 81



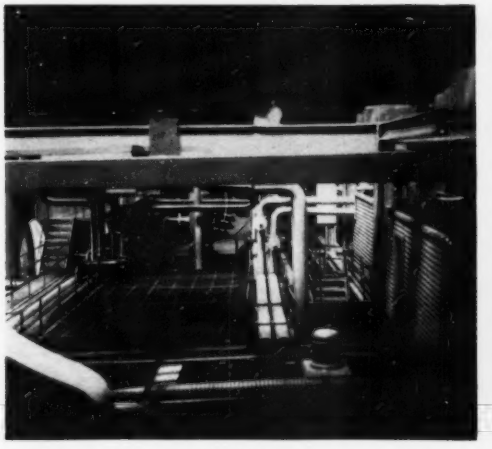
STATION SIDE VIEW shows, from left to right, turbine room, auxiliary bay, boiler room. Model splits to open in sections



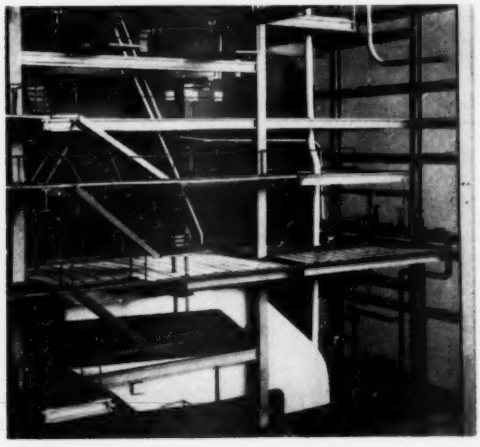
COAL BUNKER AT TOP OF BOILER ROOM will store anthracite having 12.5% moisture and feed mills below in the basement



OPERATING LEVEL BELOW TURBINE FLOOR shows main turbine stop valves, steam-jet air ejectors and other piping

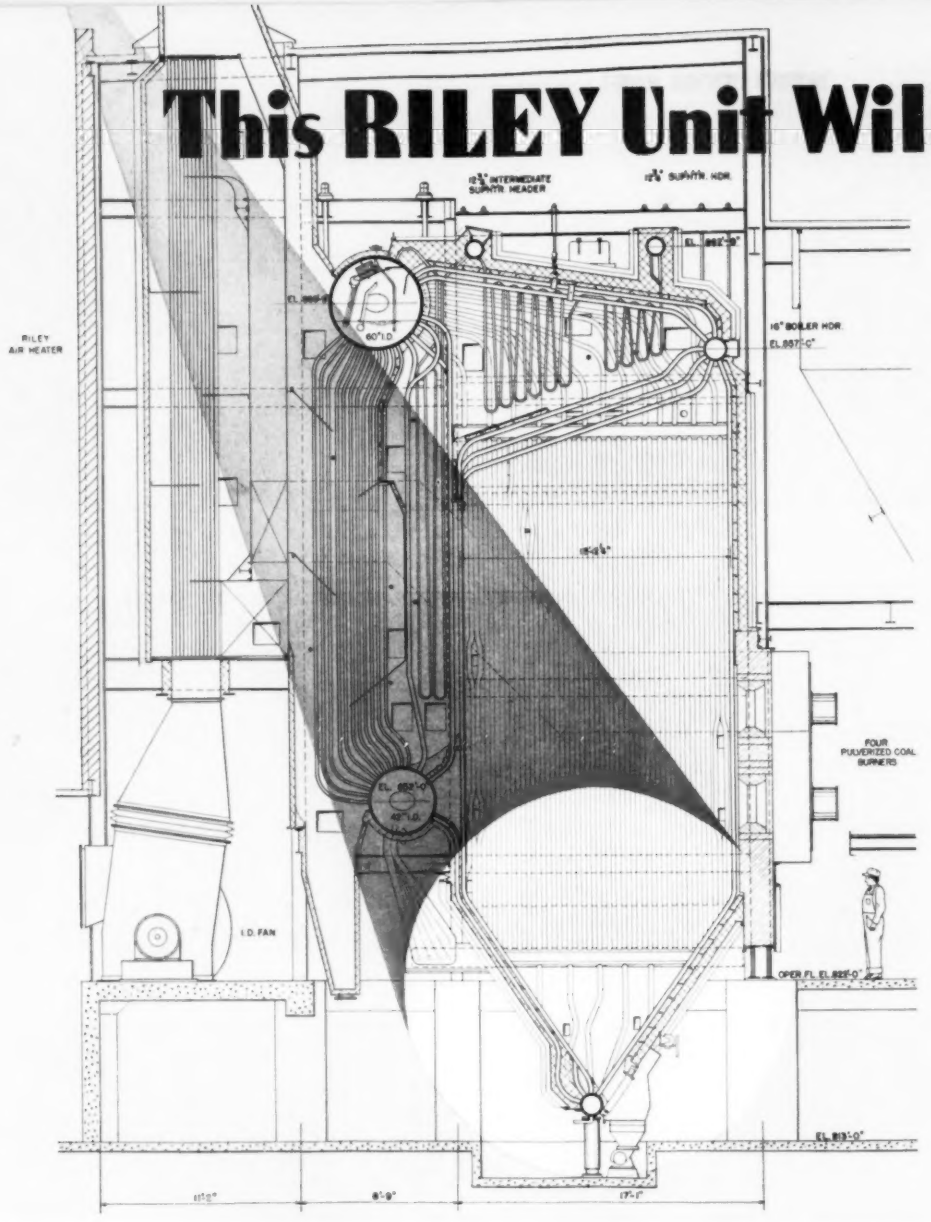


AUXILIARY BAY BELOW TURBINE FLOOR shows the meticulous detail of the model, giving lifelike impression of actual scene



SECTIONED MODEL DETAIL shows arrangement of air duct and mill-discharge lines at boiler burner level, at left center

This RILEY Unit Will



TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul Pittsburgh Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Tulsa

BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · FLUE GAS SCRUBBERS

Reduce Investment Costs

by reducing building height

With this design of Riley unit for a given steam capacity the required building height is reduced by a minimum of five feet under that required with older designs. This saves not only in building costs if a new building is being constructed, but also reduces the cost of supporting steel for the boiler unit. If the unit is being installed in an existing building a higher capacity unit can be installed.

by eliminating costs of seals between unit and ash hopper

Seals between the steam generating unit and ash hopper and alloy drip castings are eliminated with this design. This design not only saves the cost of these items but also eliminates maintenance of them.

by eliminating cost of separate ash hopper

The requirement of a separate ash hopper is completely eliminated with this design, not only saving the cost of such a separate hopper but also foundations or supporting means.

also reduces maintenance

As no separate ash hopper is required maintenance of the ash hopper is eliminated. Likewise troublesome maintenance and corrosion of seals and drip casting is eliminated.

and increases efficiency

With this Riley design there is no loss of efficiency due to evaporation of water where that type of ash handling system is employed. This often represents a material fuel saving.

lowers costs without sacrifice of operating advantages

These significant initial investment costs are saved without sacrificing in any way the operating advantages of the older designs. Users invariably report entire satisfaction and ease of ash removal with this design. Again Riley has made a significant contribution in decreasing the cost of steam generation.

A few of the companies who saved money by ordering this design of Riley unit.

Chase Brass & Copper Co., Waterville, Conn.
150,000 lbs./hr.—925 lbs.—825°F.

Carnegie Illinois Steel Corp., Rankin, Pa.
300,000 lbs./hr.—625 lbs.—750°F.

Esso Standard Oil Co., Bayonne, N. J.
200,000 lbs./hr.—300 lbs.—475°F.

Waldorf Paper Products Co., St. Paul, Minn.
150,000 lbs./hr.—700 lbs.—750°F.

Celanese Corp. of America, Rock Hill, S. C.
150,000 lbs./hr.—675 lbs.—750°F.

Upper Michigan Power & Light Co., Escanaba, Mich.
150,000 lbs./hr.—450 lbs.—750°F.

Calumet & Hecla Consolidated Mining Co., Calumet, Mich.
180,000 lbs./hr.—950 lbs.—830°F.

Celanese Corp. of America, Narrows, Va.
200,000 lbs./hr.—675 lbs.—750°F.

Carnegie Illinois Steel Co., Gary, Ind.
250,000 lbs./hr.—775 lbs.—825°F.

American Viscose Co., Marcus Hook, Pa.
150,000 lbs./hr.—415 lbs.—700°F.

Hooker Electrochemical Co., Niagara Falls, N. Y.
140,000 lbs./hr.—300 lbs.—saturated

Bird & Sons, E. Walpole, Mass.
175,000 lbs./hr.—650 lbs.—750°F.

Monsanto Chemical Co., Everett, Mass.
100,000 lbs./hr.—980 lbs.—825°F.

Northern Paper Mills, Green Bay, Wisc.
100,000 lbs./hr.—700 lbs.—700°F.

Central Ohio Light & Power Co., Bluffton, Ohio
120,000 lbs./hr.—500 lbs.—835°F.

Norton Company, Worcester, Mass.
50,000 lbs./hr.—740 lbs.—750°F.

Champion International Co., Lawrence, Mass.
70,000 lbs./hr.—450 lbs.—625°F.

Savannah Sugar Refining Co., Savannah, Ga.
100,000 lbs./hr.—300 lbs.—650°F.

Here is what some users say about this Riley hopper design.

"We are very definitely satisfied with this unit and certainly would not hesitate in installing another bottom of this type."
NORTHERN PAPER MILLS
Green Bay, Wisc.

"We are so well pleased with this unit that a duplicate unit is now being installed."
HOOKER ELECTROCHEMICAL CO.
Niagara Falls, N. Y.

"If we were installing additional units we would not hesitate to specify the present type of hopper bottom."
GOULD PAPER COMPANY
Lyons Falls, N. Y.

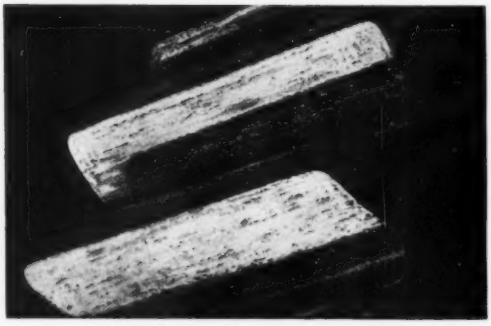
"We have had no difficulty in cleaning ash from the single header hopper bottom. Ash flows readily down the slope of the hopper."
CENTRAL OHIO LIGHT & POWER CO.
Bluffton, Ohio

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

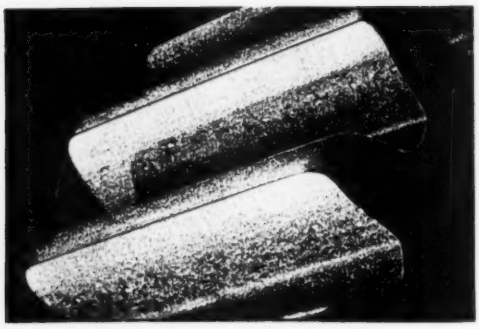
COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

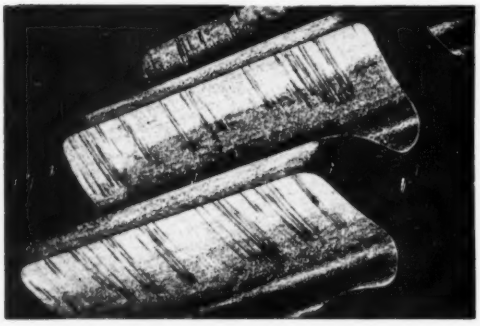
ECONOMIZERS · WATER-COOLED FURNACES · STEEL-CLAD INSULATED SETTINGS · AIR HEATERS



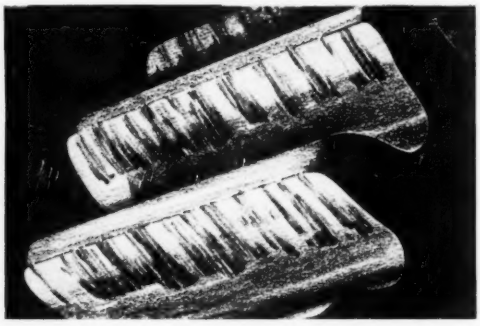
1 NORMAL WEAR refers to gradual smoothing and polishing of working surfaces of teeth. It is often spoken of as running-in. With proper design, manufacture and operation a condition is reached after which wear practically ceases. These conditions are associated with gears correctly selected for their application, properly installed and lubricated



2 INITIAL PITTING applies to formation of pits of pinhead size or smaller in the tooth surfaces, usually starting near the pitch line. Do not consider pitting detrimental unless it advances beyond the initial stage. If pits develop gradually and do not increase rapidly, they indicate a temporary condition that may disappear entirely during normal wear



5 SCRATCHING may be described as similar to abrasion except that marks are deeper, more widely separated. It occurs when lubricant carries comparatively coarse particles between engaging tooth surfaces. It generally results in rapid wearing away of the teeth unless it is checked by cleaning the gear case thoroughly, and then using the correct lubricant



6 SCORING is caused by overloading or inadequate lubrication. It can occur in properly designed, manufactured and installed gears if operating conditions cause metal-to-metal contact between teeth. Scoring in initial stages may at times be eliminated by applying more effective lubrication, for instance substituting a general-purpose extreme-pressure type

Know Your Gear Teeth

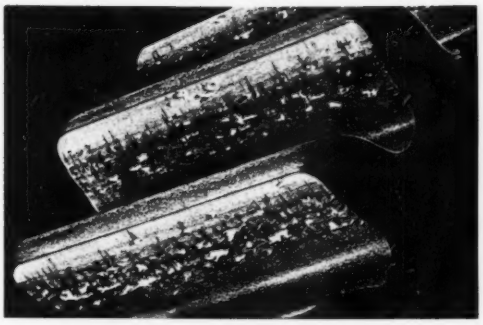
► To AVOID MISUNDERSTANDING that might arise between users and manufacturers regarding different kinds of gear-tooth wear and failure, American Gear Manufacturers Assn has developed standard terms. When properly selected, installed and maintained, gears are, in general, reliable and give long service with minimum attention. But properly designed and manufactured gears may fail in operation if improperly mounted and lubricated, or for these reasons:

(1) Center distance, if too short, results in too little root clearance; in backlash if too long. (2) Misalignment causes excessive shaft deflection, poorly related parts, worn bearings and gears, and other faults. (3) Poor lubrication, or not enough. (4) Foreign matter in lubricant or between gear teeth, such as abrasive dirt or metal particles worn from teeth. (5) Excessive temperature. (6) Excessive loads or shock loads. (7) Vibration. (8) Excessive speed. (9) General abuse.

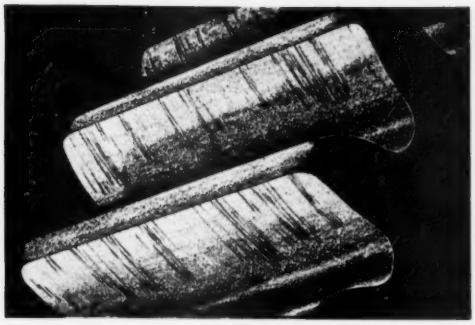
These conditions cause various kinds of tooth surface wear and failure through breakage, some of which are descriptive of the appearance of tooth surfaces. Tooth wear and failure are designated by terms to classify and identify the tooth surfaces resulting from different operating conditions.

While the tooth-surface appearances are identified by different terms, some surface conditions are quite similar. For instance, the difference between abrasion and scratching is largely a degree of roughness on the surface of teeth.

Other kinds of wear at the start may be of a minor nature, but if conditions



3 PROGRESSIVE PITTING. A failure like this is indicated when pits continue formation at an increasing rate in both number and size. A point may be reached when the unpitted areas of the surface of the tooth are too small to carry the load. Then the shape of the tooth is destroyed, particularly after continued operation at relatively high loads



4 ABRASION is manifested by a wearing away of the tooth surface at a fairly rapid rate. It is generally caused by foreign matter, such as dirt, grit or metallic particles, in the lubricant. Failure of material on the tooth surface may also cause it. It appears as fine scratches, up and down the tooth profile, that may result from improper lubrication

7 GALLING is an aggravated case of scoring caused by particles of metal torn from the tooth surface in a way sometimes referred to as seizing and welding. It is more likely to occur if two comparatively soft gears of the same hardness operate together under heavy overloads. If not corrected, it results in general disintegration of the gear-tooth surfaces

8 BURNING is indicated by tooth-surface discoloration. This type, associated with high temperature, shows excessive temperatures actually occurred and may have been caused by overspeed, overload, faulty lubrication or a combination of these. Burning may reduce hardness of hardened-steel gear teeth and worm threads, unsuiting them for specified loads

Gears are usually highly reliable but they can develop several types of trouble whose story is generally written on the tooth face. What all this means is here told, with pictures and data supplied by the American Gear Manufacturers Assn

become more severe the effects on tooth surfaces may produce a different appearance. This is particularly true of scoring, which under severe conditions leads to galling, seizing and welding. Keep these changes in mind when studying the photos showing tooth appearance for different kinds of wear and failure.

The kind of failure and its appearance depends on the material in the gear teeth and operating conditions. When reporting or describing failures be sure to include all facts about these two factors. For example, chipping and spalling look like fatigue failures, so unless all facts are known one condition may be confused with another.

Identifying gear trouble after it develops is important, but how to prevent it is even more so. When handling and installing gears be careful not to distort or otherwise damage teeth, bearings or other parts. If gears are damaged before they go into service trouble is likely no matter how high the quality.

Speed reducer units have their gears and bearings enclosed and aligned in a heavy casing. Install these units on a rigid foundation to prevent vibration and maintain alignment. Support the casing on its foundation correctly so when the holding-down bolts are tightened they will not distort the casing and throw gears and bearing out of alignment.

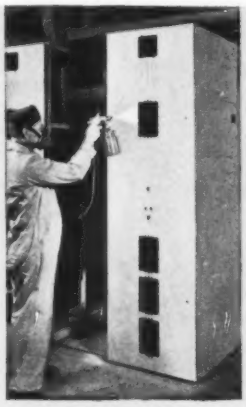
Remember that modern gears are built of high-grade materials, machined and ground to great accuracy, and should be so treated. Such treatment always pays big dividends in long life and reliable service.

CONTINUED ON PAGE 110

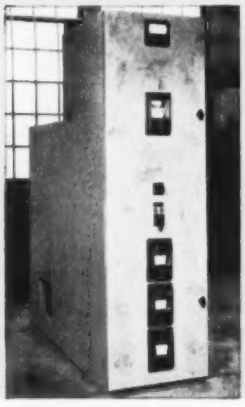
YOU CAN BE SURE.. IF IT'S Westinghouse

IN 1947

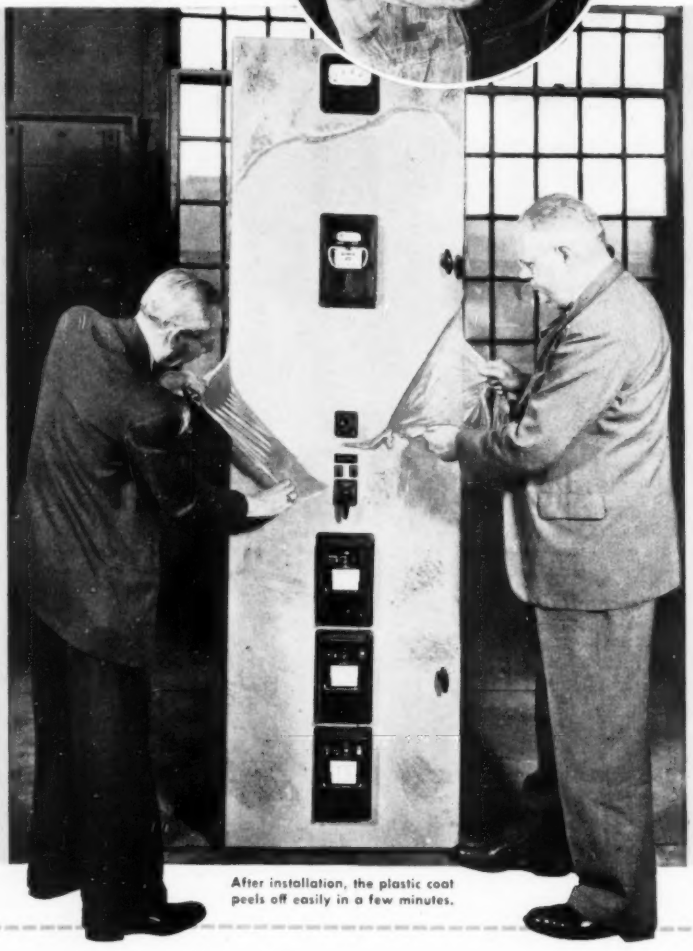
Westinghouse provided All-Weather Undercoating... Lifetime protection for undersurfaces of *outdoor* switchgear



Plastic coating is sprayed on the switchgear panel before assembly, just after final painting.

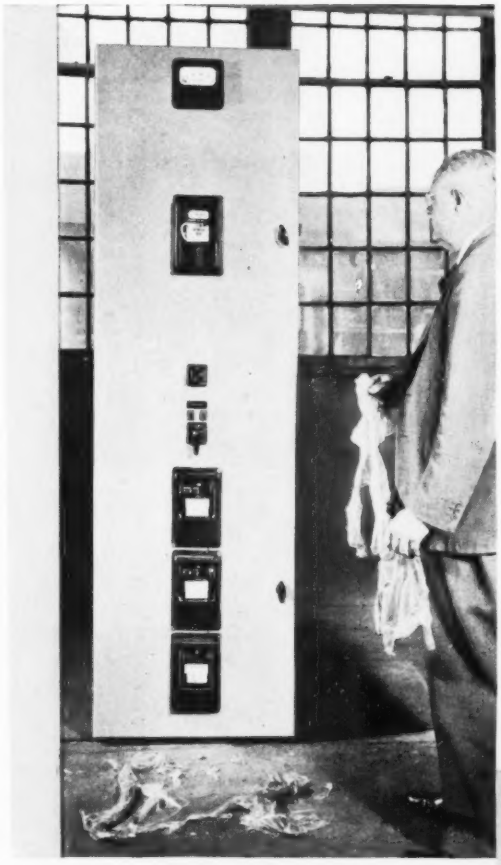


Unavoidable smudges and grease on this switchgear unit affect only the protective plastic coating.



After installation, the plastic coat peels off easily in a few minutes.

NOW... **PLASTIC PROTECTION for Indoor Switchgear**



Removal of the plastic coat reveals the original smart appearance of the switchgear unit.

Another Westinghouse Switchgear Feature

AT NO ADDED COST!

Dust, dirt and greasy fingerprints "peel off" switchgear units in a few minutes. The new plastic coating protects the smart appearance of metal-clad switchgear during shipping and installation. No longer is touch-up and repainting necessary to give your installation that "fresh-from-the-factory" appearance.

To give you this added benefit, Westinghouse employs a transparent plastic material. Sprayed on indoor metal-clad switchgear panels after final painting, it forms a tough protective coating that protects the finish through final assembly and wiring—and during shipment and installation. When the switchgear is ready for operation, simply "peel off" the plastic coat. Your installation then reveals the original factory finish. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

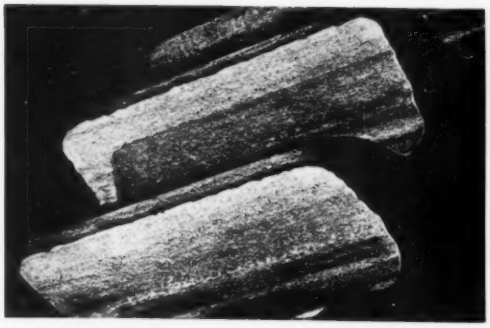
J-60689

Westinghouse

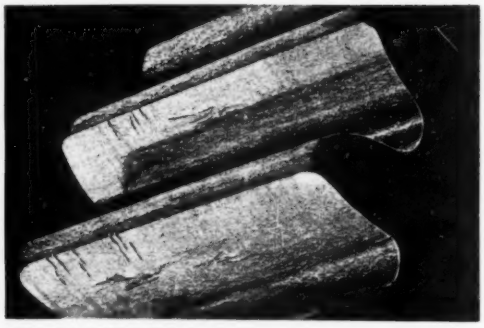
METAL-CLAD SWITCHGEAR

FOR ANY SYSTEM

KNOW YOUR GEARS *Continued from page 107*

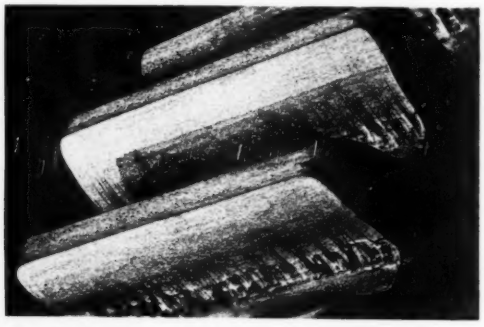


9 ROLLING, PEENING. This plastic flow of gear-tooth surface may occur if gear metal is ductile in compression, lacks proper hardness. One effect of rolling is forming of slight fins at top edges of teeth. Rolling refers to plastic flow under continuous heavy loading. Peening occurs if intermittent loading causes plastic flow of metal by hammer blows



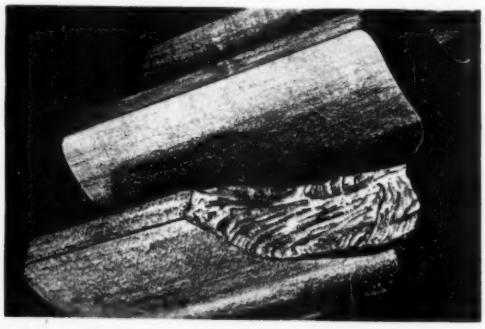
10 CRACKING, CHECKING. The first applies to single or scattered cracks in tooth surface, second to numerous, closely grouped cracks in tooth surface. Cracking may be produced by (1) loading and lubrication conditions causing excessive temperature (2) excessive hardness. Often cracks and checks can only be found by etching or by magnaflux method

11 CHIPPING refers to the breaking off of portions of the metal at the edges or boundaries of the teeth, as the photo above clearly indicates. This condition is sometimes called spalling. When chipping develops under normal load it indicates excessive brittleness of the steel. If this action cannot be stopped, the gear teeth may break and the gear fail



12 GOUGING may occur in unhardened gears if there is interference between driving-pinion flank and driven-gear tips. Top edges of gear teeth may gouge out material from near the roots of pinion teeth. A similar effect may occur between the edge of a hardened worm thread and the teeth of a worm gear. It causes wearing of the gears and loss of effectiveness

13 FATIGUE BREAKAGE. Teeth break from repeated loading. It is usually indicated by cracks at locations of high stress, which extend in area and depth until failure occurs. The condition does not necessarily mean faulty design or manufacture. It is merely breakage after a large number of load repetitions as compared with few excessive-load applications



14 OVERLOAD AND BREAKAGE refers to gear-tooth breakage that results directly from an unexpected shock or overload, such as could be caused by jamming the driven machine. This condition cannot be attributed to faulty gear design or manufacture. It is a case where something has to fail, and so the gear gives way to save other parts of the machine

"Give us the tools . . ."

What Are *YOUR* Chances If There Are No Profits?

Since the November 2 election there has been a dazzling variety of plans to have the government do more and more things and spend more and more money. But there is almost no variety in the plans which are suggested to raise the money.

"Pay for it by taxing profits," is the standard refrain. Slap on an "excess" profits tax. Boost the corporations' income tax rate.

Well – why not? Haven't the corporations been making so much money that a big chunk of it can be turned over to the government spenders without hurting anybody?

The answer is no!

How high profits should be can be debated endlessly. Some people claim that 1948 corporation profits, which will amount to about $20 billion, are too high. They emphasize the fact that profits are larger in relation to investment than they were a few years ago. Other people think profits are low. They stress the fact that profits are not much larger in relation to sales than they have been historically. Both sides agree that in some individual cases profits have been too high, as in others they have been too low or non-existent.

But if we cut the total volume of profits drastically, we shall do so at our national peril.

There is no room for debate about that. For we shall choke off the crucially important job of building new plants and equipment for our industries. Squeeze hard enough, and America will go the way of Britain – down the long and painful skids of industrial decline. Widespread unemployment, especially among our industrial workers who produce new plants and equipment, will mark the dreary way. Here is a fact which the President, the Congress, the C.I.O., and all of us have a real reason to remember:

Almost two-thirds of all profits today are going to rebuild and improve plants and equipment.

More than $13 billion of this year's profits are being plowed back. They are going – as a large proportion of profits have always gone – to buy for workers better tools to work with, better surroundings in which to work. They are making possible better products, and more of them, for all of us.

The figures below show how companies have put more and more profit-dollars and a larger share of their profits to work in the business:

YEAR	PROFITS REINVESTED	% OF TOTAL PROFITS
1929	$2.6 billion	31%
1939	1.2 "	24%
1943	5.9 "	57%
1944	5.2 "	53%
1945	4.2 "	47%
1946	6.9 "	55%
1947	11.2 "	62%
1948 est.	13.0 "	65%

continued on next page

The record shows that each of us is the real beneficiary of this plowing back of profits.

Every American has benefited from these profits. Each dollar that business has put into its plants and equipment in the last thirty years has increased our yearly production by 35 cents.

This re-investment of profits has helped make possible a 75% increase in living standards since 1919.

It has helped increase wages from an average 48 cents an hour in 1919 to $1.36 today. Allowing for higher prices, that increase means that an hour's work today will buy twice as much as it did thirty years ago.

Why must business retain these billions of profits to improve its plants and equipment? Why must it plow back more and more? *The reason is that business already is caught in a tax squeeze.*

Federal taxes alone take at least thirty-eight of each one hundred dollars a company earns. Then, if the company pays out to its stockholders any part of what is left as dividends, the federal personal income taxes of the stockholders may take up to 77% of those dividends. Under these conditions, so few people are willing to invest in industry that the stock market is stagnant. Companies can not raise in that market the money they need for improvements.

The result: business must rely more and more on plowed-back profits to pay for new plants and equipment.

We know that everywhere in industry new and better ways of producing goods are standing ready for use. The previous editorial in this series mentioned some of them. We know, too, that depression and war put our industries far behind schedule – as much as $100 billion behind – in getting the new tools they should have had to keep themselves in first-class shape. McGraw-Hill is now completing a survey of industry that will measure these needs. The results will be published in this editorial series. We know already that in 1949 alone industry will need $18 billion or more for this purpose.

And all but a small fraction of that sum must come from profits.

Our prosperity, our strength as a nation, our hopes for better living depend on our continuing to generate and to plow back a large volume of profits.

For that reason we should not thoughtlessly follow these people who propose to pay for any and all new government activities by saying simply, "Soak the corporations." There is no need to follow them. There are other ways of obtaining necessary funds.

First and foremost should be economy within the government itself. If its citizens must pay still higher taxes, then surely government should exercise rigid self-restraint, cutting out all but the most essential activities and expenses.

After economy should come consideration of a broader federal tax base.

If these and other methods of raising money are inadequate and if taxes must take a bigger bite from business profits, two facts are clear. We should not adopt an "excess" profits tax with all of its complications and all of its corrupting effect on business. A moderate increase in the regular income tax on corporations is much less dangerous. *But even such an increase, if necessary, should be accompanied by special allowances for expansion and depreciation that will encourage companies to continue spending their earnings for new plant and equipment.* We all have a stake in that.

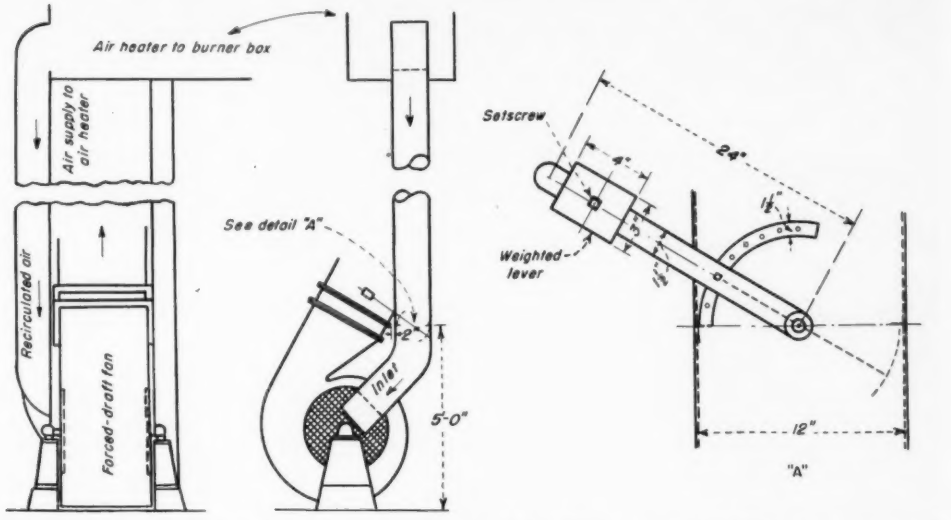
At this critical juncture in our history profits have a new and vastly more important role than they have ever had. In unprecedented degree they are the drive behind our present prosperity and the key to a better, stronger future.

Give profits the axe and the blow does not stop there.

It cuts into the employment, the prosperity and the strength of our nation.

Everyone of us has a stake in how the President and Congress handle taxes on profits – and now is the time to remind them of that stake.

President, McGraw-Hill Publishing Company, Inc.



TAPPING INTO air-heater outlet, left, with a one-square-foot connection permitted pulling hot air back to the forced-draft fan inlet, center. Tight-closing damper, right, shuts off recirculating air flow if metal holds 300 F temperature

Prevent Plugging Air-Heater Tubes

Changes in fuel composition, especially sulphur and moisture content, can produce operating headaches by plugging up preheater tubes. Here's how Sergio Martinez, chief engineer, in Bauta, Cuba, got around his problem by recirculating air

► OUR PLANT has three 55,000-lb-per-hr steam generators equipped with air preheaters. These preheaters carry 375 straight 2-in. OD tubes, 16 ft long. Gas leaving the furnace travels downward through the inside of the tubes and incoming air passes upward around the outside of the tubes.

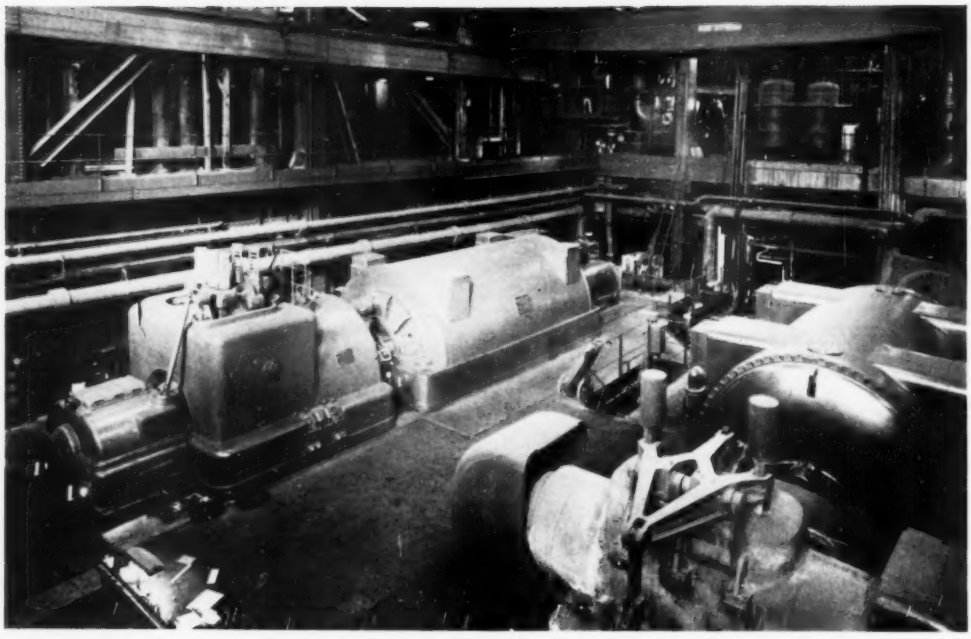
For several years operation of these heaters was troublefree. We opened up and cleaned them out twice a year, but that was all. Then about eight to twelve months ago they began plugging up—so much so that we had to clean them out at least every two weeks.

Combustion remained good; in fact, nothing seemed changed, so we analyzed the deposits found on the tubes. They turned out to be sulphates. A check on the oil then being received showed a sulphur content between 2 and 3% against our usual oil of 1% sulphur. The deposits, we felt, came from condensation of flue gas. Some way had to be found to prevent that condensation.

Preventing Condensation. We knew condensation of moisture-laden sulphurous gases could occur in a tubular air heater, particularly at light loads, in the lower part where cold air comes in and tube-metal temperature is lowest. The arithmetic mean of entering air temperature and leaving gas temperature roughly approximates tube temperature.

We also knew from experience that our tube temperature should stay at least 275 F to prevent condensation because we had (1) high sulphur content oil (2) high moisture loading from steam-atomizing oil burners and soot blowers. With either a low sulphur or moisture content, metal temperature could run much less than our 275 F without condensation troubles. Furthermore, condensation is much more apt to develop if sulphur occurs as SO_3 or the heater tube has a slight hygroscopic ash coating.

But once we knew what the deposits were and how they formed we took steps to eliminate them. These steps were to raise the metal temperature. This we did by making a one-square-foot connection from the air-heater air outlet, see above, back to the forced-draft fan inlet. We fitted this connection with a tight-closing damper. Now we recirculate some hot air at low loads through the air heater and raise metal temperature. At those loads where, without any recirculation, metal temperature stays above 275 F, preferably 300, we can cut off recirculation with the damper.



1 Two 50,000-kw superposed turbine-generators in the Sherman Creek Station, Consolidated Edison Co of N. Y., take steam at 1600 psig, 950 F, exhaust it to station header at 200 psig, 485 F. Unit No. 10 at left, Unit No. 9 at right

Sherman Creek's Topping Unit No. 10

Largest steam generators in existence serve topping units exhausting into 200-psig station header. Here's brief review of operating experience of boiler and turbine installation

By **H KNECHT,** *Mechanical Plant Engineer,* and
R T ROBERTS, *Division Engineer,*
Consolidated Edison Company of New York, Inc

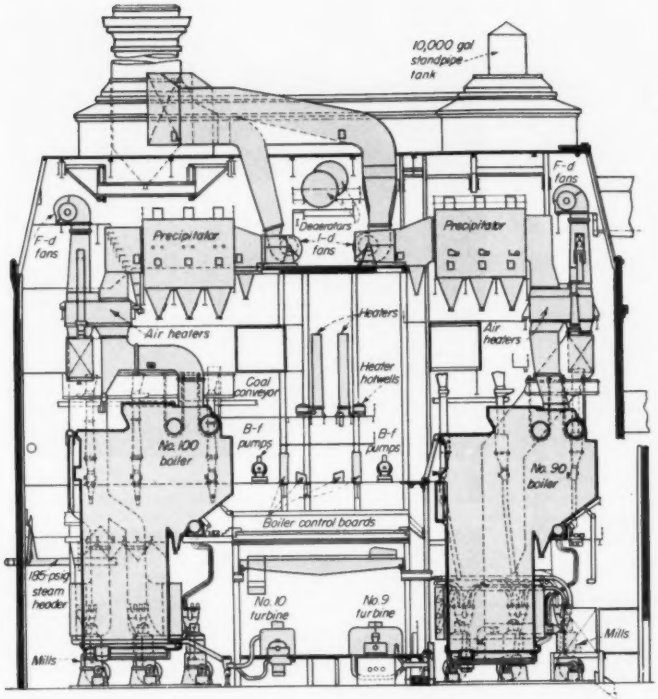
► FIRST HALF of the modernization program at the Sherman Creek Station of the Consolidated Edison Co of N. Y. was largely completed on Oct 20, 1947 when unit No. 10 with its boiler No. 100 was placed in service. This projected program calls for an ultimate installation of four 50,000-kw superposed turbines, each supplied by its single high-pressure steam generator, exhausting into the existing 200-psig header supplying eight turbines with a total rating of 171,000 kw. Last of the present low-pressure boilers will be removed to make room for the 4th topping unit. Four topping turbines and four 1,000,000-lb-per-hr h-p boilers will eventually occupy the original double-deck boiler room.

Boilers. At this writing, Nos. 90 and 100 steam generators are the largest in operation. They provide 1600-psig 950-F steam at the turbine valve. No nonreturn valves are in the h-p steam main between superheater outlet and turbine valve, and no cross connections are provided between boilers of both units.

Three bowl-type pulverizers serve each boiler. On No. 90 three burners in each of the four corners fire the furnace tangentially. On No. 100 there are four burners in each corner, piping from one of the mills subdivides to feed the bottom two burners. This allows more intimate mixing of coal and air, and lessens the tendency to produce furnace waterwall corrosion.

The upper burners can be tilted vertically to aid in controlling superheat; this operation is adjusted manually from either the boiler control room or at the burners on No. 90 and at the burners only on No. 100. In both boilers a damper at the economizer inlet controls the division of gas flow between superheater, convection and boiler passes. In No. 100, Fig. 5, closer regulation of superheat is achieved by providing auxiliary dampers. Simultaneously, they partially close the superheater pass whenever the main damper opens to let a greater proportion of gas flow through the boiler pass.

Because of the large air and gas volumes handled, two regenerative air heaters, two forced-draft and two induced-draft fans, all in parallel, are used for each boiler. The two fans of each pair are driven by a common turbine taking



2 Two topping units with their boilers stand in former location of low-pressure boilers they replace, feed low-pressure turbines in bay on left-hand side

Completes First Year

steam from the 200-psig header (topping-turbine exhaust) and exhausting into the deaerating heater at 3 psig for feedwater heating.

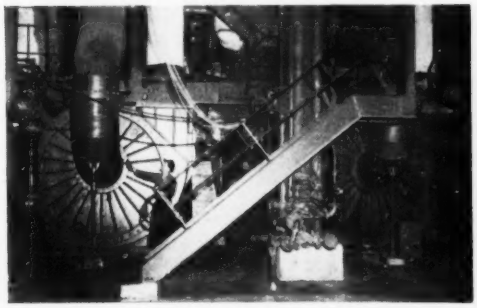
Air Heaters. To diminish corrosion and fouling of the heater plates during low loads there are bypass ducts around the air heaters between f-d fan discharge and secondary-air duct.

The air heaters have two layers of preheater surface at the top or cold end, 6 and 4 in. in depth. Made of widely spaced Cor-ten steel and placed in baskets they can be quickly removed and replaced when fouled. Increasing the spacing of the cold-end elements has made it easier to keep them clean. Extra baskets are kept on hand so replacements can be made immediately and washing done at leisure. Top layer of baskets are removed and washed about every three to six months. The lower elements on No. 90 were washed in place once while the top baskets were removed, and then dried out by gas heating before being put back in service.

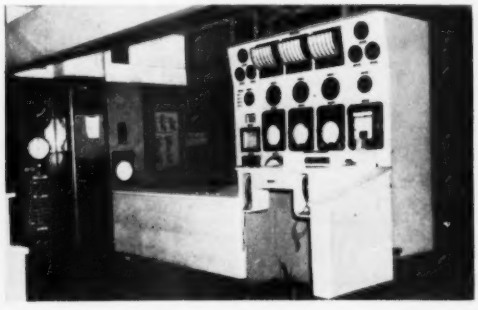
Each heater has a single-nozzle reciprocating soot blower, which is operated for a half hour during each watch. Six days per week blowing is done at 300 psig, on the seventh day at 400 psig. Air-heater operation has proved generally satisfactory.

In addition to the air-heater blower, soot blowers are provided for the furnace, boiler, superheater and economizer. Motor-driven telescopic blowers in the side walls clean the superheater in No. 90. Eighteen air-cooled roof blowers in No. 90 were removed and not provided in No. 100. Telescopic and retractable blowers ahead of screen tubes were installed in both boilers. Three watercooled telescopic blowers are installed on the south side of each boiler because of restricted space, while on the north side, steam-cooled retractable blowers are used. All blowers couple into an air-controlled sequence system. Any group of blowers can be cut out of the sequence and by a simple manipulation of handles on the control board, the entire system can be put in operation, automatically stopping when the selected points have been blown.

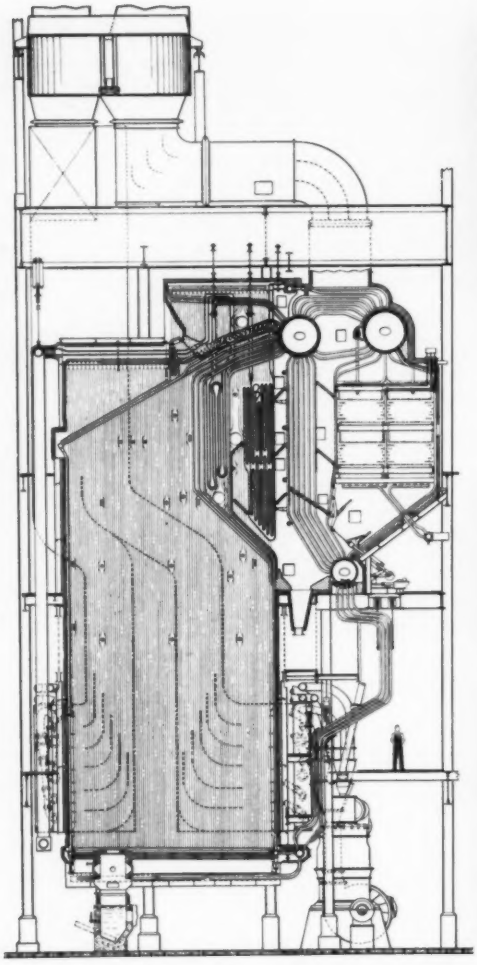
Each steam generator has an electrostatic precipitator, three sections long, fitted with steel-plate electrodes. They are the largest of their type, designed to remove 95% of the solids at a gas flow of 460,000 cfm with 340-F gas temperature. Four electrical sets operate at half wave on the first two



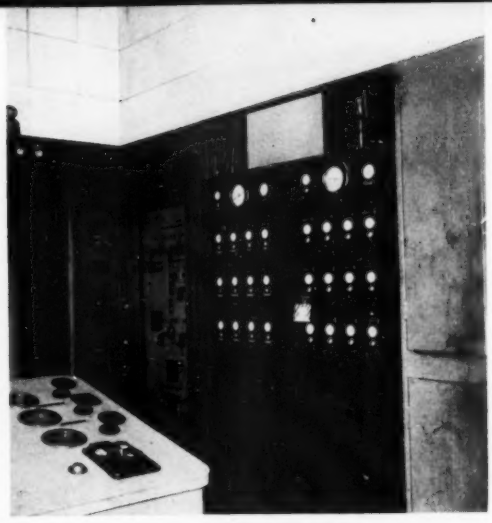
3 Air inlet and discharge piping for two of three mills per boiler. Pulverizers serve corner burners in furnace



4 Bench board and vertical panel centralize the control at this point for boiler No. 100 serving turbine unit No. 10



5 Single 1,000,000-lb-per-hr steam generator feeds 1625-psig 955-F steam to turbine, uses two air heaters above



6 Panels in boiler-control room remotely control sequential soot-blowing system throughout the steam generator

7 Mechanical rakes remove slag from pit, underneath boiler slag tap, automatically dumping into cars for disposal

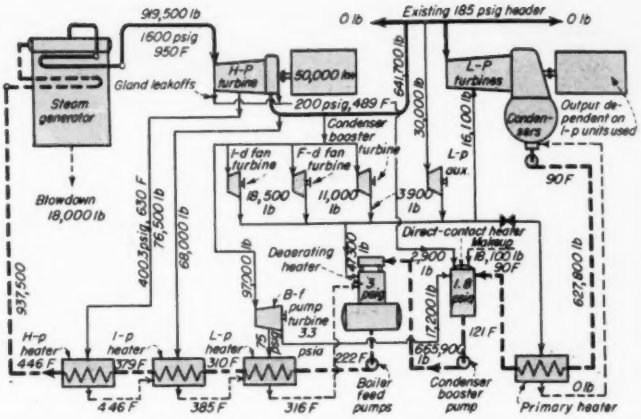
sections and either full or half wave on the last section of the electrostatic precipitator.

Ash and Dust Handling. A pneumatic system transports flyash and dust from hoppers under the precipitators, ducts and boiler collection points to ash pockets on the station dock. The vacuum pumps in a room above the ash pocket run by remote control from a board at the boilers. The system operates either automatically or manually; sequential control changes loading in the system from point to point. Flyash discharges through three rotary conditioners to make it dustless. All three dustless unloaders discharge to reversible belts in parallel so ash can be unloaded either outboard to barges or inboard to trucks.

A problem arose in handling slag from the wet-bottom furnaces. Limitations of the plant site required utilization of the existing ash pocket. Stoker-boiler ash is transported by car from the boiler ash hoppers to a skip hoist which lifts and discharges the ash into the elevated pockets. This method was retained for the new boilers, but a novel method was developed for loading the cars.

As slag flows from the furnace tap it falls through a water spray and disintegrates into particles about the size of rice. A leaf damper directs the cooled slag to one of two adjacent pits, each having an inclined bottom, see Figs. 5 and 7. A mechanical reciprocating slag rake mounted over each pit alternately moves back and forth over the inclined bottom. The rake lifts when moving down to the lowest point in the pit where it then lowers into the collected slag and pulls it part way up the incline. By repeating these two strokes succeeding batches of slag move up the incline and drop over the apron into a car for removal to the skip hoist. The system is designed for convenience and cleanliness.

Main Turbines. In both Nos. 9 and 10 the main steam piping anchored at the turbines expands vertically, and is taken up in the long horizontal flex-



8 Plant heat balance takes steam for feedwater heating from auxiliary-drive turbine exhaust and bleed, topping unit exhaust, and from main unit bleed point

ible superheater tubes that tie into the spring-supported superheater header. Both turbines are designed for the same steam conditions at inlet, bleed and exhaust. No. 9, however, has an initial impulse stage followed by 16 reaction stages. Of six control valves, five admit steam to different sections of the first-stage nozzles and the sixth, an internal bypass valve, admits steam to the 8th stage.

No. 10 has 14 impulse stages and a double shell. Ten control valves in two groups of five each are mounted on the upper and lower control-valve casings, which are integral with the top and bottom outer turbine shells. Six admit steam to different sections of the first-stage nozzles and four bypass overload steam to the fourth-stage shell. All valves are controlled by the governor, which is the centrifugal type driven by the turbine shaft through a worm gear. A quick-closing oil-operated stop valve can be tripped either by hand or emergency governor in event of overspeed.

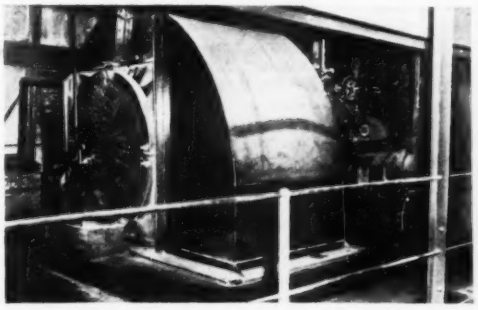
No. 10's two main gear-type motor-driven oil pumps are in the main oil tank in the basement. An auxiliary steam-turbine-driven oil pump, also in the tank, functions during starting and stopping of the main unit. A pressure regulator automatically starts this pump when oil-system pressure drops below a predetermined value. Another small motor-driven oil pump supplies oil to the bearings when the unit is revolved by the turning gear during shutdown periods.

No. 10's hydrogen-cooled generator rated at 62,500 kva with 0.8 pf can develop 115% of rated kva with 15-psig hydrogen pressure. Four extended-surface type hydrogen coolers stand vertically, one at each corner of the generator outside the core portion. Water connections at the bottom and all water gaskets externally located prevent leakage into the hydrogen space. Fresh water cools the hydrogen, in turn being cooled in another exchanger by salt water.

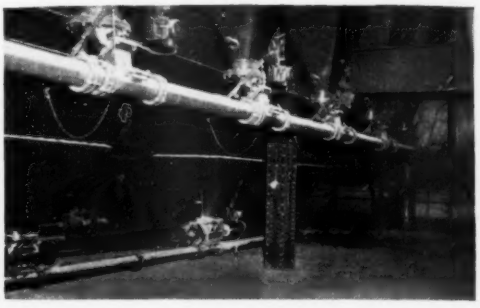
Feedwater System. Condensate from the l-p-turbine hotwell pumps, Fig. 8, discharges into a common header feeding two open heaters supplying the l-p boilers and the direct-contact heaters of the h-p units. Condensate goes first to the direct-contact heaters and the excess to the open heaters for use in the l-p boilers. Vertical booster pumps in the condensate header to the direct-contact heaters start up automatically when these heaters' pressure rises to atmospheric.

The direct-contact heater receives its steam from exhaust of the boiler-feed-pump turbine and the h-p turbine-gland leakoffs. At full load the heater for No. 10 operates at 1.8 psia, that is, as a condenser. Venting is done by a twin steam-jet air ejector with integral direct-contact precooler and surface-type aftercondenser.

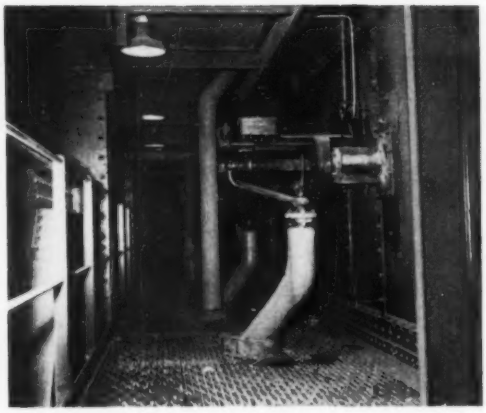
Two condensate booster pumps, one a spare, take the water from this heater and pass it on to the deaerating heater. This direct-contact tray-type deaerator has two vent condensers so valved that either may be taken out of service for overhauling, without removing the deaerator from service. Heating steam at about 3 psig comes from exhaust of the f-d and i-d fan-drive turbines and the condensate-booster pump turbines. Drains from the three closed heaters following the feed pump also trap into the deaerator. If additional heating steam is required it can be taken from the l-p station auxiliary exhaust header. Bleed points from some of the l-p turbines tap into this header, which can either supply bleed steam when needed



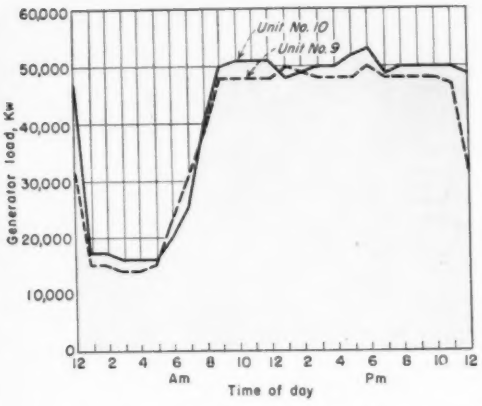
9 Two 156,000-cfm fans serve single boiler; they are driven by common mechanical-drive turbine, exhaust to deaerator



10 Pneumatic system removes flyash from precipitator hoppers, background, flue hoppers, foreground, to ash pocket



11 Automatic retracting wall blowers on south side of boiler 100 are remotely supervised from boiler-control room



12 Most frequent daily operation of the topping units keeps them loaded during day and evening, falls off at night

or absorb any excess exhaust that may appear.

Feedwater at about 222 F flows from the deaerator to the suction of the h-p boiler feed pumps. Deaerator elevation maintains a positive suction head in excess of 40 psig at the pump center line. Two of the three variable-speed turbine-driven feed pumps can handle full-load flow. The 8-stage pumps have an outer barrel and horizontally split inner casing. Normal full-load capacity of each pump is 460,000 lb per hr against a total dynamic head of 1800 psig at 4150 rpm.

Pumps are directly driven by automatic-extraction condensing turbines, rated at 1357 hp at 4150 rpm when taking 185-psig 485-F steam. The single extraction point supplies steam at a constant pressure of 70 psig to the closed l-p heater. The exhaust steam supplies the direct-contact heater at 1.8 psia. Turbines will develop a maximum of 1685 hp at 4340 rpm under the same steam conditions. This capacity will be needed when carrying full load with only one set of heaters in operation. In emergencies these units may be put into service immediately without warming up. For normal warming-up periods a turning gear rotates the unit at about 13 rpm.

Feedwater to the boiler can be controlled by (1) automatic (2) remote manual and (3) local manual means. The 3-element control system varies the speed of the boiler-feed-pump turbines to maintain a balance of water flow against steam flow, compensated by drum-level variation.

From the common boiler-feed-pump discharge header, the water passes through two parallel rows of closed heaters. Each row consists of one l-p heater using steam at 70 psig from the boiler-feed-pump turbine extraction; one intermediate-pressure heater using steam at 195 psig from the h-p turbine exhaust and one h-p heater using steam at 390 psig from the h-p turbine bleed point. Normally feedwater flows equally through both sets of heaters. If it becomes necessary to remove one heater from service, the row of which it is a part may be isolated by closing a valve ahead of the l-p heater and another after the h-p heater. Full flow then passes through the remaining set of heaters with an increased pressure drop, but maintaining reasonable cycle efficiency.

Operating History. The rejuvenation of Sherman Creek by topping is graphically illustrated by comparing its annual output for 1942 before No. 9, the first topper, was installed with the 12-month output for the period ending Nov 30, 1948 during which the two toppers operated. Annual output for 1942 was 269,274,894 kwhr; for the latter 12-month period, 1,418,794,880 kwhr. Conversion of this high-heat-rate standby station to a low-heat-rate base-load station has been one economical means of meeting present-day rocketing load demands.

Since its initial operation on Apr 6, 1943 till Nov 30, 1948, No. 9 turbine has operated for 39,057 hr producing 1,565,050,000 kwhr and its boiler No. 90 has generated a total steam output of 33,880,725,500 lb. No. 10 turbine, since initial operation on Oct. 20, 1947, has operated up to Nov 30, 1948 a total of 8426 hr producing 354,700,000 kwhr and its boiler No. 100 has generated a total of 7,054,877,000 lb of steam.

Availability of the first topper and its boiler follows:

Year	*No. 9*	*No. 90*
1943	89.9%	90.6%
1944	89.8	94.9
1945	96.5	93.0
1946	92.2	95.1
1947	43.5	84.8
1948	97.5	86.0

Availability of the second topper and its boiler was:

Year	*No. 10*	*No. 100*
1947	86.1%	91.1%
1948	89.8	87.7

Availabilities for 1948 cover the first 11 months only. No. 9 was out over a considerable period during 1947 for correction of mechanical difficulties in the turbine.

While the topping units are high-efficiency machines operating normally on the base of the load curve, it becomes necessary to drop load during the early morning watch because there is not sufficient total load to keep all high-efficiency units on the system loaded to capacity. A typical daily load curve for the toppers is shown in Fig. 12, variations occur with system conditions.

The load drop proves beneficial because the boiler furnace automatically deslags with change in furnace temperatures and the turbines automatically clean themselves of blade deposits because of the steam temperature change in the stages. No. 9 turbine was washed with saturated steam one time when salt entered the h-p boiler because of a serious leak developing in one of the l-p turbine condensers. No. 10 has never been washed, the almost daily load

PRINCIPAL POWER-PLANT EQUIPMENT

No. 10 Unit, Sherman Creek Station • Consolidated Edison Co. of New York, Inc., New York, N. Y.

STEAM-GENERATING EQUIPMENT:

Boiler and waterwalls, 1 ..... Combustion Engineering Co
1,000,000 lb per hr, 1600 psig, 950 F, bent-tube boiler, bifurcated waterwall tubes, 14,100-sq-ft boiler, 10,995-sq-ft waterwalls, furnace volume 53,700 cu ft, furnace-heat release at full load, 21,900 Btu per hr per cu ft, 4 tilting burners per corner with oil-ignition torches, tangential pulverized-coal firing

Superheater ..... Combustion Engineering Co
Pendant type, 28,200 sq ft, bypass damper control

Economizer, 33,960 sq ft ..... Combustion Engineering Co

Air heaters, 2 ..... Combustion Engineering Co
Ljungstrom regenerative, 124,800 sq ft each

Pulverizers, 3, bowl type ..... Combustion Engineering Co

Pulverizer drives, 3 ..... General Electric Co
300 hp, 900 rpm, 3 phase, 60 cycle, 2300 v motors

Precipitator, 1 ..... Research Corp
Electrostatic, 95% removal at 460,000-cfm gas at 340 F, three sections long, steel-plate electrodes

Induced-draft fans, 2 ..... American Blower Co
Two on common drive shaft, 225,000 cfm each at 320 F, 15 in. H_2O static pressure, 598 rpm

Induced-draft fan drive, 1 ..... Westinghouse Electric Corp
Drives two fans, 1700 hp at 4700 rpm with 185 psig, 485-F steam exhausting at 3 psig, gear reduction, 8.06 ratio

Forced-draft fans, 2 ..... American Blower Co
Two on common drive shaft, 156,000 cfm each with 120-F air, 15-in. H_2O static pressure at 1227 rpm

Forced-draft fan drive, 1 ..... General Electric Co
Drives two fans, 946 hp at 5760 rpm with 180 psig, 485-F steam, exhausting at 3 psig, gear ratio 4.7

Soot blowers ..... Diamond Power Specialty Corp
Retracting wall blowers, telescopic blowers at arch, superheater inlet and bank; rotating elements in convection surface and economizer; elements steam-blow sequentially controlled by air from central panel-board

Combustion control ..... Republic Flow Meters Co

Feedwater control ..... Bailey Meter Co

Control bench board and panel ..... Falstrom Co / Schvetz & Hadeler

Blowdown system ..... Babcock & Wilcox Co
Existing system, one high- and one low-pressure flash tank in series, flashes 150,000-lb-per-hr blowdown

COAL- AND ASH-HANDLING EQUIPMENT:

Flyash handling ..... United Conveyor Corp
Extension to existing pneumatic system, loading points at boiler, precipitator, flues and stack, discharging to ash pockets on wharf, duplicate cyclone receivers and bag filters (1 set a spare), capacity 7½ tons per hr

Ash-handling drives ..... General Electric Co
75-hp 1775-rpm 208-v 3-phase 60-cycle motors remotely controlled from separate control panel at boiler

Flyash conditioner ..... United Conveyor Corp
One rotary type installed in parallel with two existing units below ash pockets, capacity of each 25 tons dry ash per hr

Conditioned flyash conveyors ..... Stephens-Adamson Manufacturing Co
One 30-in. reversing pelt conveyor, in parallel with existing two, moves outward to discharge to scows, inward to discharge to trucks, capacity of each 50 tons per hr. Driven by 2-hp 116-rpm 3-phase 60-cycle 208-v totally enclosed dust-tight weatherproof motors

Coal-distributing conveyor ..... Stephens-Adamson Manufacturing Co
Existing Redler conveyor rearranged to load at 6 additional points and discharge to 3 new and 3 existing mills. Capacity 20 tons per hr

Coal-conveyor drives, 2 ..... Westinghouse Electric Corp
7½-hp geared motors

GENERATING EQUIPMENT:

Turbine, 1 ..... General Electric Co
50,000-kw 0.8-pf 3600-rpm single-flow double-shell 14-stage impulse-type. Throttle steam, 1600 psig, 950 F, exhaust at 200 psig, 485 F, bleed at 400 psia

Generator, 1 ..... General Electric Co
50,000-kw 0.8-pf 62,500-kva 3-phase 60-cycle 13,800-v 3600-rpm hydrogen-cooled unit. Direct-connected aircooled exciter

FEEDWATER SYSTEM:

Direct-contact heater, 1 ..... Elliott Co.
Vertical, jet-type counter-flow with twin steam-jet air ejectors. Rated capacity to condense 20,000-lb-per-hr steam with 642,000-lb-per-hr feedwater to 3 psia pressure with outlet temperature of 140.5 F

Deaerating heater, 1 ..... Elliott Co
Direct-contact tray-type with 2 vent condensers. Rated capacity 1,100,000 lb per hr, 18 psia, 1000-cu-ft water storage. Dissolved O_2 content not to exceed 0.005 cc per liter (Schwartz-Gurney)

Low-pressure heaters, 2 ..... Foster Wheeler Corp
Vertical, 2-pass, U-tube with integral hotwells; 2090-sq-ft heat-transfer surface each, 70-psig steam pressure, 80-20 cupro-nickel tubes

Intermediate-pressure heaters, 2 ..... Foster Wheeler Corp
Vertical, 2-pass, U-tube with integral hotwells; 1910-sq-ft heat-transfer surface each, 195-psig steam pressure, 80-20 cupro-nickel tubes

High-pressure heaters, 2 ..... Foster Wheeler Corp
Vertical, 2-pass, U-tube with integral hotwells; 2650-sq-ft heat-transfer surface each, 390-psig steam pressure, 80-20 cupro-nickel tubes

Condensate booster pumps, 2 ..... De Laval Steam Turbine Co
Single-stage double-suction type, 20-ft suction lift, 1800 gpm

Condensate booster-pump drives, 2 ..... Westinghouse Electric Corp
Turbines, 1875 rpm, 185 hp, 200 psig, 485 F

Boiler feed pumps, 3 ..... Byron Jackson Co
Horizontal 8-stage double-case volute type. Normal rating, 460,000 lb per hr each, 1800 psig, 222 F, 4150 rpm

Boiler feed-pump drives, 3 ..... General Electric Co
1785-hp variable-speed single-automatic-extraction condensing turbine. Steam at throttle, 2000 psia, 485 F, at exhaust 4 psia

Chemical feed pumps, 2 ..... Proportioneers, Inc.
Duplex, high-pressure for phosphate and caustic. Capacity range per cylinder 0.03 to 0.3 gpm at 2200 psig

Feedwater treatment ..... The Permutit Co
Makeup from existing l-p condensate system or from existing sodium-hydrogen softening system, capacity 50,000 lb per hr

MISCELLANEOUS PUMPS:

Salt-water cooling pumps, 2 ..... Warren Steam Pump Co
Single-stage double-suction, capacity each 2000 gpm against 100-ft total net head including 22-ft suction lift

Salt-water cooling pump drives, 2 ..... Westinghouse Electric Corp
Direct-connected 75-hp 1800-rpm motor

Hydrogen-cooling water pump, 1 ..... De Laval Steam Turbine Co
Single-stage centrifugal, 400 gpm against 75-ft head

Hydrogen-cooling water pump drive ..... General Electric Co
15-hp 1800-rpm motor

Gland-cooling pump, 1 ..... Ingersoll-Rand Co
Single-stage centrifugal; 50 gpm against 125-ft total head

Gland cooling pump drive ..... Westinghouse Electric Co
5-hp 3450-rpm motor

PIPING:

Piping ..... Cornell & Underhill / M W Kellogg Co

Valves ..... Edward Valves, Inc / Chapman Valve Manufacturing Co / Walworth Co / Crane Co / Manning, Maxwell & Moore / Cochrane Corp / Atwood & Morrill Co / The Wm Powell Co / Kennedy Valve & Manufacturing Co. / Reading, Pratt & Cady Div

Automatic-control valves ..... Republic Flow Meters Co / Fisher Governor Co

INSTRUMENTS:

Pressure gages ..... Crosby Steam Gage & Valve Co

Temperature recorders ..... Leeds & Northrup Co

Industrial thermometers ..... Taylor Instrument Cos / Moeller Instrument Co

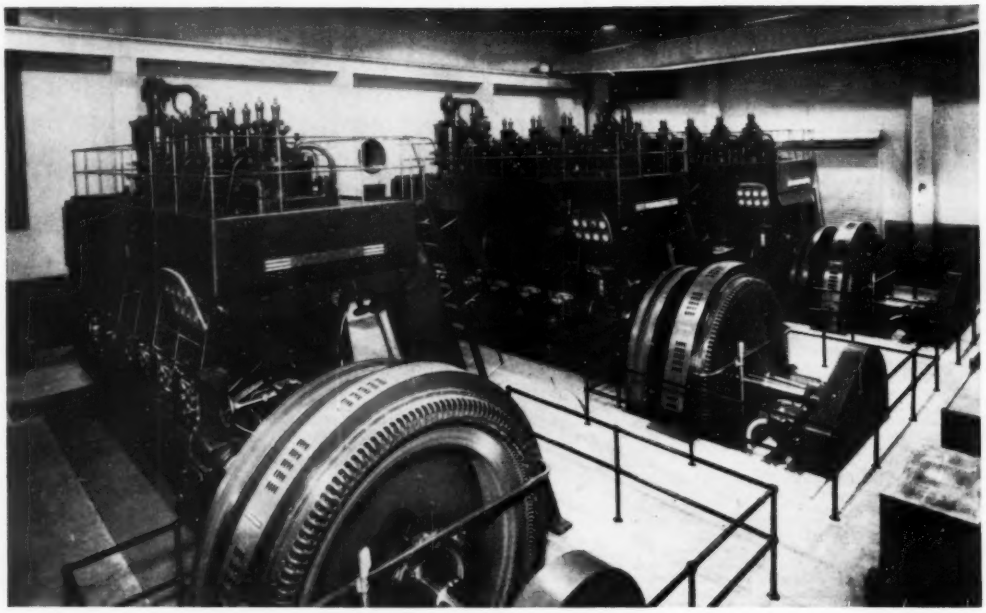
Flowmeters ..... Builders-Providence, Inc

Turbine crane, 35 ton ..... Northern Engineering Works

change having kept it clean of deposits.

Additional vent, drain and blowoff connections have been installed on the boilers to fill and drain rapidly for acid washing at intervals. No. 90 has been acid washed 12 times, and No. 100 was washed three times.

Auxiliary steam turbines are washed with saturated steam whenever the steam-inlet pressure rises 25 psi above design at full load. This has been at 12- to 18-month intervals on No. 9 unit.



Managed Diesel Maintenance Pays Off

Like the railroads, maintenance needs a schedule. When it's organized the plant hums along smoothly, operating costs go down. Here are some practical tips on setting up a work plan

► ARE YOU GOING to run the maintenance job or is it going to run you? If you expect to sit in the driver's seat, you've got to do some careful planning to stay ahead of trouble. In the well-run plant unexpected maintenance is rare. Regular inspection gages the progress of normal wear, spots troubles before they become serious. Following through with scheduled maintenance brings diesel parts back to top-notch condition, ready for additional hours and months of service.

Setting up a thorough inspection and maintenance schedule forms the first step in organizing to get on top of the maintenance job and stay there. Lots of things affect this schedule—type and make of engines installed, kind of load plant carries, nature of fuel burned, skill of operators. Only someone entirely familiar with a given plant can make a schedule for it and no two schedules will be exactly alike. Thus the typical schedule on the facing page represents merely an example to show what one looks like and how the engineer tackles the schedule-making job for his own diesel plant.

Basis for Schedule. In working out a schedule consider both engines and accessories. *Operating hours* form the basis for timing maintenance operations on engines that run regularly. For standby units, and for accessory equipment, piping, etc., it is customary to base schedules on *elapsed time*. Devices for recording hours of operation of individual engines are available; they prove helpful in following the maintenance program and also in dividing load between units.

As a first step, decide on the period to be allowed between major overhauls. This usually means dismantling the engine for complete inspection or, for large units, sufficient dismantling to check all major items. In fixing the interval between overhauls, give heed to the engine builder's recommendations and to actual experience in the plant. Usually, about 8000 to 10,000 hr elapse between overhauls. For convenience 8000 hr are used in the typical schedule, facing page. This represents about one to two years time, depending on load factor. It is customary to specify annual overhaul for accessories and plant piping.

Complete Overhaul. Thus in our hypothetical plant we plan on a complete dismantled inspection, followed by adjustment and reconditioning, every 8000 hr for the engine and each year for the rest of the plant. Actual work to be done should be put in writing in the form of complete overhaul instructions. Besides being educational, such a work list serves an essential purpose in guiding the men doing the job, insuring that nothing is overlooked. It is particularly useful when new or untrained men are used on the work.

Some inspection and maintenance operations must be carried out one or more times between overhauls, either in full or in less complete form. For

TYPICAL INSPECTION AND MAINTENANCE SCHEDULE

	ROUTINE OPERATIONS	QUARTERLY OR EVERY 2000 HR	SEMI-ANNUALLY OR EVERY 4000 HR	ANNUALLY OR EVERY 8000 HR
VALVE MECHANISM	Check lubrication and adjustment hourly		Remove and inspect for wear on moving parts	Remove and inspect for flat spots and wear on moving parts. Check roller clearance
CAMSHAFT AND DRIVE			Check and adjust camshaft gears, chain	Inspect camshaft and drive. Adjust bearing clearance, gears, chain. Examine cams for tightness, wear
VALVES	Check operation hourly. Inspect monthly	Inspect and grind exhaust valves	Inspect and regrind inlet and exhaust valves. Check spring length, tension	Inspect and grind valves. Check spring length and tension. Inspect stem bushings, guides. Adjust valve timing
INJECTION SYSTEM	Check spray-valve tightness each time engine shuts down. Indicate engine weekly	Inspect and clean nozzles (oftener if needed)	Clean and test nozzles. Clean and grind fuel-pump valves, inspect plungers	Clean and test nozzles. Check all moving parts for wear and adjustment. Check and recondition all pump and check valves
STARTING SYSTEM	Check for leaky starting valves, blow air tanks, check safety valves—daily	Drain air lines to remove trapped moisture	Clean and grind air valves. Check pressure gages. Inspect piping for leaks	Dismantle and recondition air valves. Overhaul air compressor Check piping. Inspect and clean air tanks. Check pressure gage.
LUBRICATION SYSTEM	Check mechanical lubricators; oil all hand-lubricated parts hourly. Clean strainers daily. Check filters, centrifuges weekly	Examine piping for loose joints, leaks. Clean heat exchgrs, dirty-oil tanks	Examine piping; clean heat exchangers, dirty- and clean-oil tanks. Flush crankcase. Inspect lube-oil pumps	Flush crankcase. Inspect lube-oil pumps and recondition. Renew packing. Dismantle, clean and repair relief or bypass valves. Inspect and clean oil piping, tanks
PISTONS			Pull pistons and clean. Inspect piston and rings	Pull pistons, remove rings, check condition. Clean and inspect piston, oil-cooling pipe. Check ring end clearance, side clearance
CYLINDERS AND HEADS	Blow out indicator connections daily	Examine and clean cylinder heads	Examine and clean heads. Inspect and wash jackets	Inspect and clean heads and jackets. Measure liner diameter. Check gasket annealing
WRISTPIN AND CRANKPIN BEARINGS	Open handholes, look and smell for hot bearings; listen for knocks		Check and adjust	Remove and inspect piston pins. Check bearing, and alignment of wristpin and piston. Check bolt elongation. Remove and inspect bolts and bearings. Replace and adjust bearings. Insert compression shims
MAIN BEARINGS, CRANKSHAFT			Check main-bearing alignment	Remove caps, inspect lining and journals. Take bridge-gage readings. Remove and inspect lower shells. Replace and adjust bearing clearance. Clean oil passages. Examine shaft for cracks. Measure distance between crankwebs. Check journal level
GOVERNOR, ALARMS AND INSTRUMENTS	Check operation of alarms daily. Check pressure-gage lines and clean exposed temperature-indicating elements monthly		Calibrate instruments. Check pressure gages with deadweight tester	Calibrate instruments. Check pressure gages. Dismantle and overhaul governor; check all moving parts for wear and adjustment
INTAKE, EXHAUST	Clean filters as required. Clean carbon from exhaust ports and piping, monthly			Inspect and clean carbon from exhaust ports, piping, mufflers, waste-heat boilers
COOLING SYSTEM		Inspect piping, valves. Clean heat exchangers	Drain cooling-tower basin and clean	Inspect and clean entire system. Remove scale. Inspect and overhaul valves, pumps
FUEL-OIL SYSTEM	Clean strainers daily. Check filters and centrifuges weekly		Drain water and sediment. Check heating coils for leaks	Inspect and clean oil piping, tanks, etc. Overhaul pumps. Inspect and repair filters and strainers. Check meters or gaging devices
ELECTRICAL EQUIPMENT	Inspect all brushes each shift. Clean generators, exciters, motors, switchboards and commutators monthly	Clean, adjust and calibrate watthour meters	Clean and calibrate indicating instruments and relays. Inspect circuit breakers and clean	Clean, adjust and calibrate all meters and relays. Clean, inspect and overhaul all rotating machinery and switchgear

example, it may be necessary to grind exhaust valves every 2000 hr and inlet valves half as often, or every 4000 hr. Usually enough of these operations are needed at the halfway mark (4000 hr here) to set up a "half-time" or "semi" overhaul. This involves partially dismantling the equipment.

Nearly all maintenance operations requiring any substantial dismantling or reconditioning work can be scheduled for quarter-time, half-time or full overhaul periods. This has the advantage of concentrating the work in a few definite intervals. Where operating conditions are severe, however, some operations, like exhaust-valve grinding and fuel-nozzle inspection and cleaning, may be required oftener.

Routine Inspection. In addition to those items that may be classed definitely as maintenance, many others require little or no dismantling or mechanical work. Examples are routine inspection of the engine while it is operating, periodic testing of safety and relief valves and cleaning operations. These are, nevertheless, an important part of maintenance and thus are included in the sample schedule, along with tentative suggestions for timing.

In actual application, the schedule only *guides* timing of maintenance operations. Such work must be planned to fit plant conditions and to take advantage of shutdown or light-load periods. While the same schedule fits all similar engines in the plant, it can naturally be applied so the work is staggered and no more than one engine is out of service at any time.

Type of schedule and maintenance program we've been talking about so far is usually found in plants where arrangements can be made to take a unit out for enough time to permit overhaul operations. Particularly today, taking a unit out for more than a few hours represents a problem in many heavily loaded plants. Here a different approach works best. Maintenance is carried out a cylinder at a time, as far as possible. With trained crews a single piston can be pulled, related parts inspected and reconditioned as needed, and reassembly completed in a short time. Jobs affecting more than one cylinder, such as checking crankshaft alignment, can likewise be sandwiched in as outage time permits.

Spare-Parts Storage. The question of spare-parts storage ties in closely with the maintenance schedule. Keeping a large stock, including major items such as cylinder heads and liners, certainly helps to speed maintenance work, but it does represent a heavy investment. Here again no definite rule can be given that applies to all plants. Each engineer must decide his spare-parts policy for himself, weighing such factors as distance from nearest source of parts, number of engine makes and cylinder sizes in the plant, severity of operating conditions, costliness of delay resulting from lack of a spare.

Reconditioning. It usually proves wise to do as much reconditioning as possible between overhauls. For example on overhaul, fuel nozzles, caged valves, etc., are replaced with spares, regardless of their condition. Then, as time permits, the parts are reconditioned as required and put into stock for return to the engine at the next overhaul. Such a procedure may require a larger-than-normal spare-parts stock but it greatly speeds the overhaul operation.

Reconditioning the parts for stock makes good fill-in work and thus helps to spread the load on the maintenance men. Also, the work can often be done more effectively and conveniently in the shop during off periods. This kind of operation is almost essential for plants where lack of shop facilities makes it necessary to send out parts requiring reconditioning.

Set Up a Record. Maintenance schedules, as we've seen, may differ widely in details, but some form of program is necessary in every plant, small or large. Equally important is a record of maintenance operations. Just how these records are kept depends on plant size, number of engines, etc. As a minimum, the operator should set down notes on condition of engine parts as revealed by inspections and measurements, and a brief report of any reconditioning work done. In addition, the record should include a report on any part that fails in service and the repair or replacement made.

In a small plant, the operator can jot these notes on the daily log sheet or in the log book. Larger plants use special forms. Sometimes a single large form is designed to cover each engine, providing space for a complete record of conditions found on each general inspection. This form is supplemented by another, which is filled out whenever a part fails in service. It shows the part involved, what happened to it, how it was repaired, what was done to prevent future failures, and labor and material costs for repair.

In other plants, operators maintain a card record for each part of each engine, showing date installed, condition at each inspection, and maintenance operations performed.

Record Provides Facts. Whatever form the record may take, it provides invaluable facts, showing a progressive picture of mechanical condition and wear. These facts permit anticipating renewals and replacements and provide a basis for building an adequate yet economical spare-parts supply. Such records also give the engineer a running check on how good his maintenance program is, and whether the job is done. Finally, maintenance records often reveal weaknesses in equipment design or plant layout, which can be corrected to eliminate a source of grief.

The modern diesel is efficient and reliable, but like any machine, parts wear and get out of adjustment. If not spotted by inspection and corrected, such conditions may get worse rapidly so that an unexpected failure results. It's then that maintenance manages the engineer—he has to hop at trouble's call. The smart engineer manages his maintenance job and sleeps nights as a result.

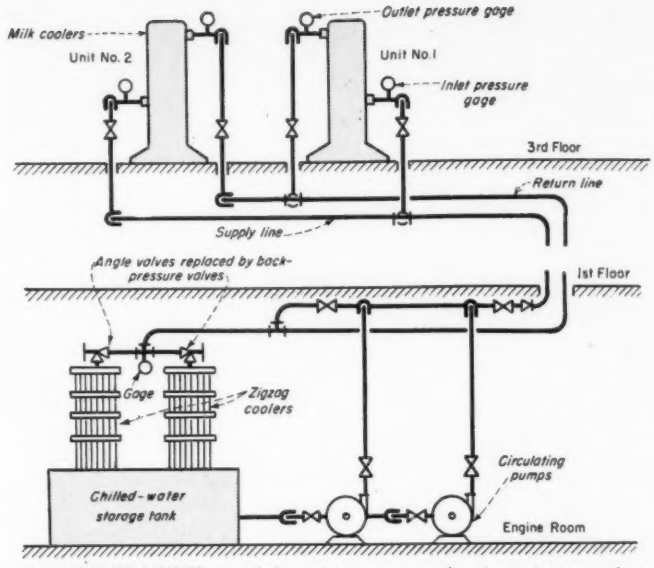
Want to Be an Editor?

To further expand the scope and quality of service to its readers, POWER plans to enlarge its staff of technical editors. Since the man we are looking for may well be found among our readers, I am taking this means of calling attention to an opportunity for a young engineer seeking an interesting and rewarding career.

The man we want is a mechanical-engineering graduate with several years' experience in design or operation of power plants, preferably industrial. He has an inquiring mind, the desire and ability to grow in engineering knowledge and judgment, and a pleasing personality. He need not have had previous editorial experience, although an interest in writing is necessary.

If you think you fill the bill, drop me a line, enclosing a statement of education and experience, and a small photo if possible.

Phil Swain



BACKPRESSURE VALVES, installed at zigzag water coolers in engine room, keep positive pressure in return line to better action of milk coolers on third floor

Backpressure Solves Water-Flow Problem

When milk cooling fell off the trouble was caused by vacuum in the return line and vapor in the coolers. Slowing up the water discharge with backpressure valves solved the problem

By **M N KRAUS,** *Assistant to Supervising Engineer, City Plants, Sheffield Farms Co.*

► PIPED IN PARALLEL on the third floor of a dairy, two plate-type chilled-water heat exchangers are used to cool milk. The units consist of gasketed stainless-steel plates, held together by a screw press, to form alternate passages through which water and milk flow. From the start, the heat exchangers did not cool the milk properly.

Water Flow. My first move was to check the quantity of chilled water flowing through the cooling sections to find out if the manufacturer's requirement of 165 gpm each was being supplied. The simplest way to do this was to put pressure gages on the inlet and outlet water bosses to measure pressure drop across the sections.

Factory tests indicated it should be 20 psi at rated flow. Actual gage readings on my test were 8 psi at the inlet and 22 in. of vacuum at the outlet, equal to a net pressure drop of 18.8 psi. This indicated that almost rated flow was passing through each cooling section. The high vacuum at the outlet, however, made me suspect that the chilled-water return line lacked a backpressure valve downstairs in the engine room.

Also, the line might be larger than necessary for total flow through the units, which meant it would flow only partly full and even pull voids or vapor pockets between plates of cooling sections. The voids could account for loss in heat transfer experienced during operation. Upon tracing out the chilled-water piping I found no backpressure valves installed (see sketch).

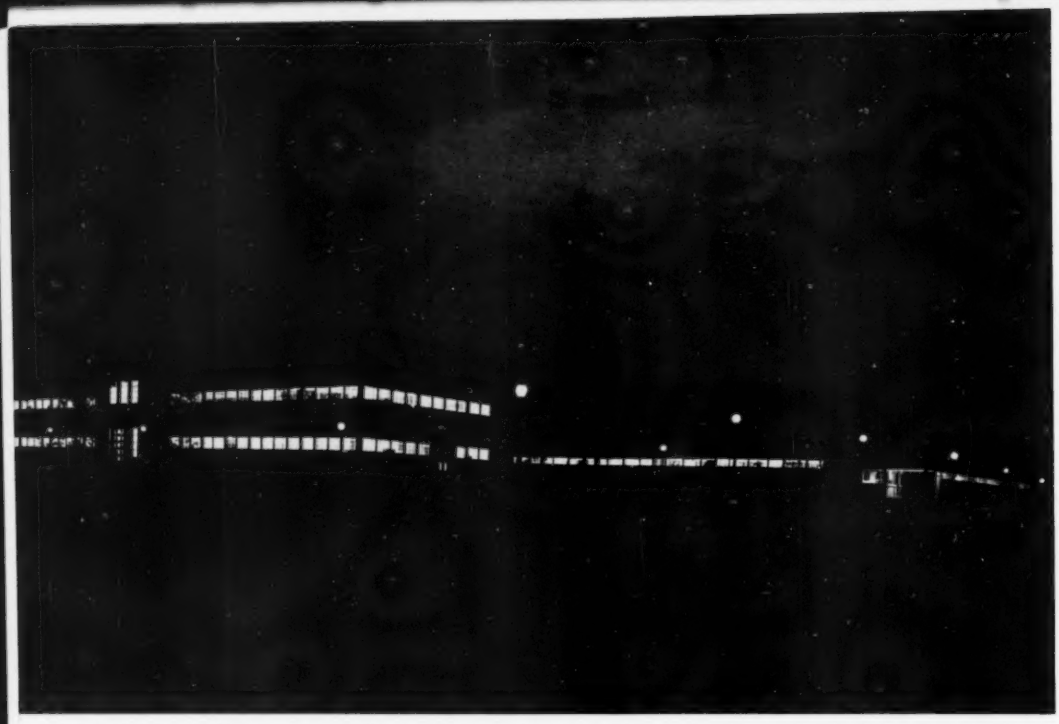
Throttled Return. To make a temporary correction, backpressure was created by closing in equally on the two angle valves at the end of the return line until just a trickle of water flowed from an open petcock installed at highest point on return line—outlet bosses of the cooling sections. Gages on the bosses then showed inlet pressure of 13 psi and outlet pressure of zero, indicating that less than rated flow was passing through each cooling section.

All this time only one water-circulating pump was operating. After starting the second pump, inlet pressure rose to 20 psi, and outlet pressure to 2.5 psi. Angle valves were readjusted until outlet pressure read zero and inlet pressure dropped to 19 psi. Pressure drop of 19 psi was evidently the best to be obtained under existing conditions with two units operating in parallel. It indicated the coolers were getting enough water for all practical purposes.

Pressure Limitations. As the pressure allowed on the plate gaskets was only 24 psi, it was possible that, if one cooler was shut down while two water-circulating pumps ran, inlet pressure on remaining unit might exceed this limit. To check this, one cooler was shut down. Inlet pressure on other unit jumped to 23.5 psi which was safe, but outlet pressure dropped to 14 in. of vacuum, evidently caused by decreased flow in return line. This proved that a spring-loaded backpressure valve was needed to maintain constant backpressure in water-return line.

A gage installed in the tee between the angle valves indicated that an 11-psi backpressure would assure zero pressure at the outlets of the cooling sections, the right value for good operation. Two 3-in. water relief valves just removed from an old pipeline were available and, despite the difference in size, were overhauled, adjusted and installed in place of the 4-in. angle valves.

The simple expedient of building up the backpressure in the return line improved the heat transfer of the cooling units to such an extent that it was possible to shut down one chilled-water circulating pump and operate with only a 13-psi pressure drop across each cooling section.



1 Night view of Western Electric, Allentown, Pa. plant shows administration building, in left foreground, and the main manufacturing building, right, both fully air conditioned. In the rear, smoke stack rises from the utilities building

3 Instrument board in monitoring room gives full check of air conditions; pushbuttons connect 48 temperature points

Air Conditioning

Manufacture of precision electronic equipment requires a closely controlled atmosphere. To meet this need, Western Electric Co's Allentown, Pa. plant employs carefully selected building materials, air-conditioning devices

► AIR CONDITIONING in the latest industrial buildings, such as Western Electric Co's Allentown, Pa. electronics plant, Fig. 1, does more than maintain bodily comfort conditions. It pays its way by furnishing a closely controlled atmosphere, highly important in turning out precision equipment. In fact, certain of the electronic elements produced at this plant fall below acceptable quality if they even contact dust or perspiration.

To meet such close requirements the plant designers, the Austin Co, carefully selected items affecting atmosphere: (1) building materials (2) air-conditioning devices.

This careful selection of building materials aids in meeting the plant air-conditioning load. As a result, the building interior has been sealed off from the outside. The effect gives a considerable time lag, as much as 12 hr for transmission of solar heat from the outdoors to the plant interior.

Building walls are 13½ in. thick. They consist, in order,

2 Typical air-conditioning unit and attendant duct work in truss area is representative of six, serving the main manufacturing area on the floor below. Each delivers 50,000 cfm to 35 air diffusers that cover an area of over 22,000 sq ft

Goes to Work as Manufacturing Tool

of an 8½-in. outside brick wall, a vapor seal, a one-in. fiber-glass insulation, a second vapor seal and, finally, 4 in. of a light-brown glazed-tile interior. The vapor seal prevents condensate, which settles out from air because of temperature difference between indoors and outdoors, from passing through and getting into insulation. Diagonal steel rods, 3/16 in. dia, bond exterior 8 in. of brick to interior tile at every fourth course, or at about 10½-in. intervals.

The window area is also insulated. Its 2 ft 9 in. vision strip, which surrounds the manufacturing building at the main floor level (375 x 450 ft) has two thicknesses of DSA (double strength America clear) glass with a 3/16-in. air space sealed in between the two panes to act as insulation.

The welded-steel roofs of both manufacturing and office buildings (see POWER, Jan, pp 64-68 for an over-all plant building layout) have a flat 20-yr bonded-type roof-covering. Material used in their construction gives a 4-hr time lag in solar-heat transmission. This material includes 2 in. of rigid foam-glass insulation laid on a 2-ply vapor seal and topped by 4-ply asphalt and slag waterproofing on top of the last coat.

Distribution Center. Beneath the steel work of the manufacturing roof lies an 11-ft-high area of open truss construction. This section houses the principal distributing duct and control work and the allied air-conditioning units, Fig. 2. It also serves as a plenum chamber for air to be recirculated to the main floor.

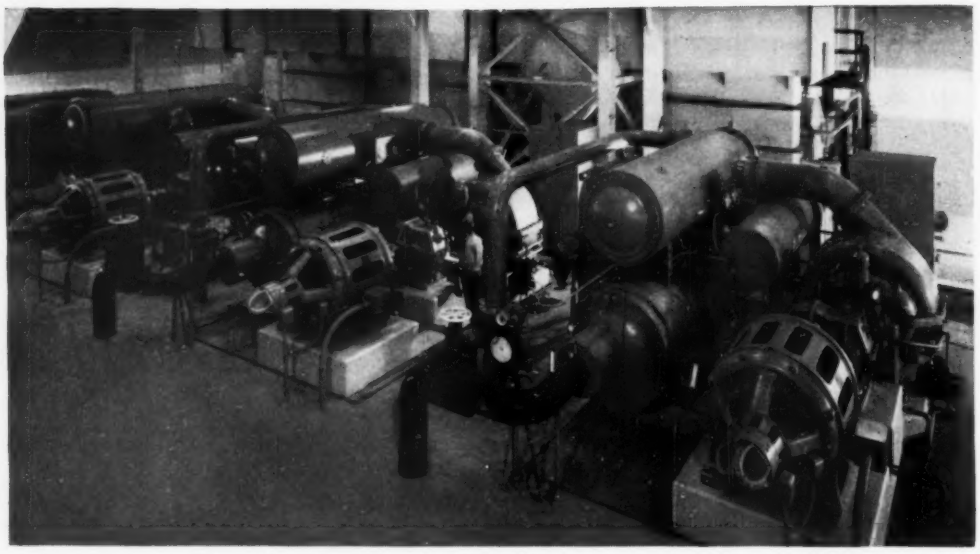
Six of a total of 10 air-conditioning units serve the interior manufacturing area making up the main floor. They are spotted evenly above the floor space, each unit handling 21,660 sq ft of ceiling. Coming off these units and set 25 ft apart in the ceiling are 208 recirculating diffusers.

Four air-conditioning units supply the building periphery at this level. Area is divided into four 7500 sq ft segments for these units, one unit in each corner of the mezzanine. On the inside wall 82 nonrecirculating diffusers mount at 12½-ft intervals. These diffusers discharge air at such an angle that the air stream does not go into the working space.

Special Loading. Air-conditioning load around the periphery differs considerably from section to section. And for this reason the four air-conditioning units serving the periphery have both manual and automatic controls. Once a given set of conditions is set up manually in the monitor room, Fig. 3, the automatic controls maintain it. Air leaving all these areas, except those under negative pressure—see below, vents off through louvers in the partitions to the manufacturing room to enter the recirculation cycle. Ventilating fans and auxiliary cooling units have been set up along the east and west walls to satisfy the special requirements of process departments along these walls.

Along the north and south walls in fan rooms on the ground-floor level are five additional air-conditioning units. They deliver air under the proper conditions of temperature and humidity to all areas of the machine shop and heavy process departments occupying the ground-floor level.

(*Continued on page* 124)



4 Three synchronous 770-ton refrigerating compressors handle up to 3720 gpm of chilled water, which is delivered to all of the air-conditioning units located throughout the building area, Fig 2. Freon serves as the refrigerating medium for all

But let's look at the air-conditioning load these 15 units meet before we discuss air changes and motion. They supply more than 500 diffuser units with air totaling some 750,000 cfm. The quantity of air exhausted and replaced runs 100,000 to 300,000 cfm.

Indoor temperature stays within an allowable range of 70 to 80 F under a relative humidity swing from 40 to 50%. These conditions apply both winter and summer. Design premise used was outside conditions of 95 F and 40% relative humidity for summer, and —5 F and 60% relative humidity for winter.

Fresh Air Supply. Amount of air taken into the building from outside depends upon (1) process exhaust (2) outside air conditions (temperature and relative humidity) (3) positive air pressure reading within the building.

Process exhaust ties directly to process output. The varying process exhaust, as a result of production variations, represents a load the air-conditioning system must meet no matter what.

Outdoor air conditions constantly change but their influence on inside loading can be closely watched. A wet and dry bulb temperature differential controller in the monitor room automatically compares indoor and outdoor air conditions. This comparison permits a decision on whether it is more economical to admit fresh air or to condition air already inside. But the base amount of fresh air essential to good health is continuously admitted.

An outdoor master thermostat resets zone submaster thermostats according to outside temperature conditions and controls air temperature within the allowable range of 70-80 F. The submaster thermostats, in turn, regulate final temperature of air leaving the diffusers in the zones they serve.

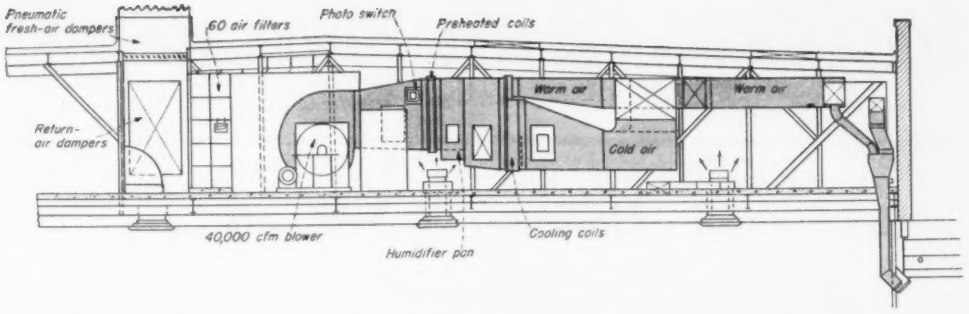
But if outdoor temperature changes rapidly a manual control in the monitor room, Fig. 3, permits regulating by hand the submaster thermostats for the manufacturing area. This precaution avoids loading the air-conditioning equipment unnecessarily. Otherwise, under automatic operation, the equipment would try to keep pace with outside temperature changes.

How about the effect of maintaining a positive air pressure within the building? Actually this pressure varies in amount throughout the plant. Within the periphery, as an example, pressure differences are sharp between some adjacent areas. The chemical-treating spray rooms work under a negative pressure, as mentioned above, to prevent fume-laden air from recirculating to other areas. In the cathode coating room, on the other hand, product quality demands a positive pressure to safeguard against any outside air-borne impurities fouling the atmosphere.

Inside Pressure. But, in general, the indoor-air pressure stays slightly greater than that outdoors. And to help maintain this positive pressure a static pressure regulator measures the difference between outdoor and indoor pressure. With this information as a guide the attendant in the monitor room admits a controlled quantity of air to hold a desired air pressure.

At this same central monitoring board, several temperature controls service the various air-conditioning systems. The six air-conditioning units, supplying the main manufacturing floor, and the five at ground-floor level employ conventional distribution equipment. This apparatus includes (1) centrifugal-type supply fans (2) steam preheater coils (3) chilled-water cooling coils (4) reheat coils (5) submerged-coil pan-type humidifiers (6) dry-type air filters. In the fan discharge of all these units, as well as the four operating in the periphery of the manufacturing area, are electronic eyes acting as smoke detectors. And, in addition, strategically located on the ground floor and the main floor are hydrogen detectors. When concentration reaches a particular level these instruments set off alarms in the monitor room and give the operator warning to (1) prevent recirculation in those areas (2) open outside air dampers full to purge affected sections of the building.

Separate Distribution. Four air-conditioning units, at the corners of the plenum chamber above the main manufacturing floor, supply air to the



5 Air-conditioning units of the "blow through" type, supplying the periphery or lean-to section of the main manufacturing floor, distribute air through a double-duct arrangement; one duct has steam heating coils, the other chilled water

periphery section of the main floor. These units are the "blow-through" type and distribute air through a so-called "double-duct" arrangement, see Fig. 5. Recirculated air mixed with outside air passes through filters to the fan intake. The fan discharges the air past preheaters into a plenum where humidifying can be done if needed. This preconditioned air splits as required into two main ducts—one equipped with steam-heating coils and the second with chilled-water-fed cooling coils. The one heats air and the other cools and dehumidifies it. The proportion drawn from each main duct to the individual-room-supply branches depends upon the requirements called for by the room submaster thermostats.

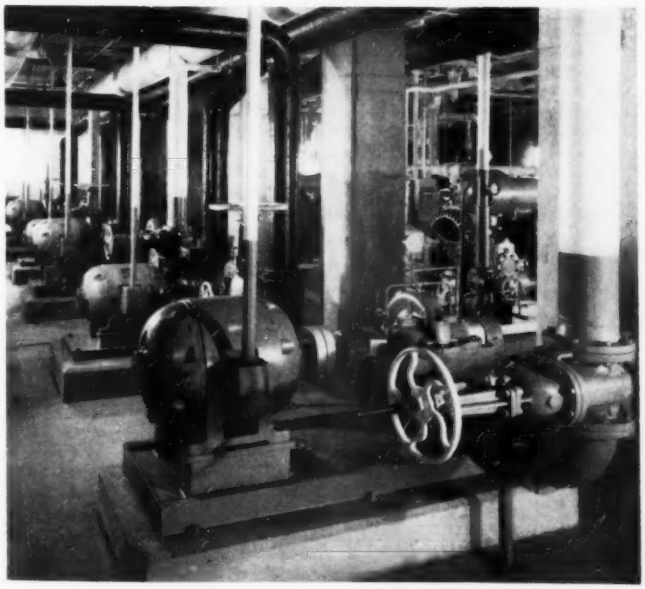
Diffuser Action. Actual movement of conditioned air within the "controlled-atmosphere" zones of the buildings depends upon diffuser design. Some diffusers have a built-in adjustable cylindrical sleeve-type damper, which can vary the quantity of air leaving the diffuser. On the main floor they can be adjusted to emit up to 25% more air than the design amount by simultaneously closing dampers on other diffusers connected to the same fan unit. This permits maintaining an even temperature throughout the building by adjusting diffusers in areas of higher than average heat release. In the periphery rooms each diffuser is fed by a hot and cold duct blending the air through a blade-type damper to maintain desired room temperature.

The air pattern differs considerably throughout the buildings. In the central area of the manufacturing building, for instance, all air supplied to the periphery must flow toward the center area. Result is that the 208 diffusers, serving the center area, have to remove about 30% more air than they deliver.

How much equipment supplies the needed warm and chilled air volume? All air for cooling needs comes from chilling by water. Three synchronous 770-ton refrigerating compressors, Fig. 4, located in the utility building (see POWER, Jan, pp 64-68) handle up to 3720 gpm of chilled water. A series of three condensers and three evaporators complete the chilled-water handling equipment.

Water for the condensers on these three Freon compressors passes, Fig. 6, at the rate of 7000 gpm through 20-in. pipelines between the utility building where the compressors are installed; an induced-draft cooling tower is located near by. This water has its temperature lowered some 10 deg by the counter-flowing air stream as the water falls in spray form down from the 25-ft-high entrance gallery distribution trough.

Whatever heat is needed for distribution within the building is added to the circulating air in the ducts by steam coils within the air-conditioning units. Steam comes from the three boiler units described previously (POWER, Jan, pp 64-68).



6 Chilled water and condenser pumps, above, installed on the ground floor of the utilities building serve the three compressors, Fig 4, showing in background

ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

10—Electron-Tube Rectifiers

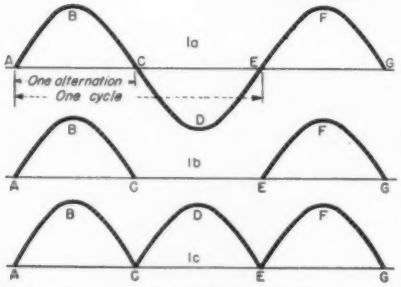
► ALL ELECTRON TUBES act as check valves in a circuit—that is, they permit current to flow through them in only one direction, from cathode to anode (POWER, July 1948, pp 108-112). This characteristic makes it possible to use them to convert (rectify) alternating into direct current. Many forms of this rectifier are used. Some have tubes no larger than a thimble, good for a few milliamperes, while others, contained in large steel tanks, handle thousands of amperes.

Fig. 1*a* shows a curve representing an alternating voltage or current. Starting at *A*, where current or voltage is zero it rises to a maximum value at *B*, and decreases to zero again at *C*. On the next wave it reverses direction in the circuit to reach maximum value at *D*, and returns to zero at *E*. In a 60-cycle system, current or voltage goes from zero to maximum, back to zero 120 times per second, passing through a complete cycle from *A* to *E*, 60 times per second.

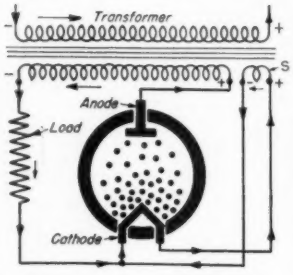
Simple Rectifiers. Fig. 2 and 3 are diagrams of a simple electron-tube rectifier. A small section *S* of the transformer secondary winding provides heating current for the cathode to cause it to emit electrons, Fig. 3. As far as the tube's operation is concerned it makes no difference which direction the current flow takes through the cathode, as long as it is sufficient to heat it to proper electron-emission temperature.

Assume that curve *ABC*, Fig. 1*a*, represents the voltage applied to the transformer's primary winding, Fig. 2. This induces a secondary voltage as shown. At the instant we are considering, polarity of the transformer secondary is such as to make the anode plus, and current flows through the load and tube in the direction of arrowheads. Current then flows through the tube during voltage wave *ABC*, Fig. 1*a*,

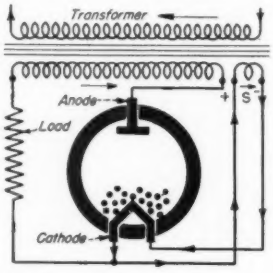
Half-Wave and Full-Wave Rectifiers



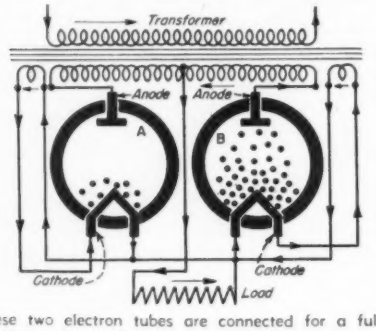
1 Ac voltage or current wave (a); current waves from half-wave rectifier (b), and full-wave (c)



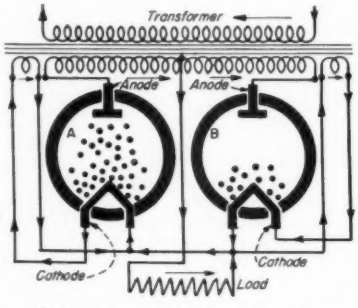
2 With this transformer polarity, flow is from cathode to anode



3 If transformer polarity reverses, tube acts as a check valve



4 These two electron tubes are connected for a full-wave rectifier with transformer polarity for B tube to conduct



5 When polarity reverses, tube A conducts instead of tube B, as illustrated in Fig. 4, for full-wave rectification

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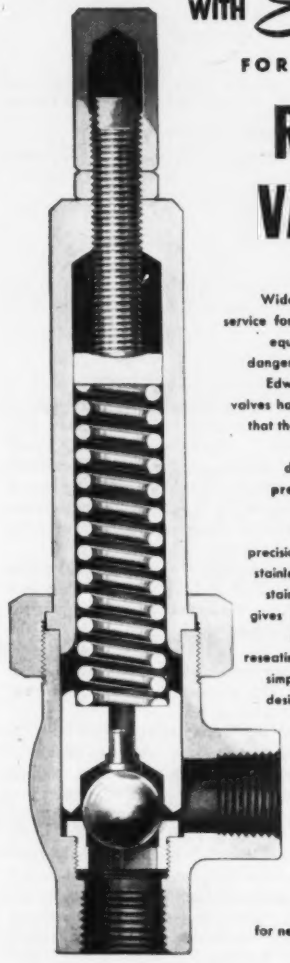

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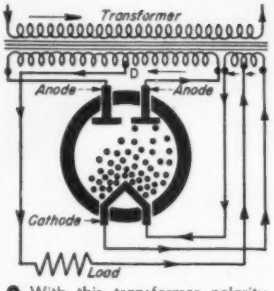
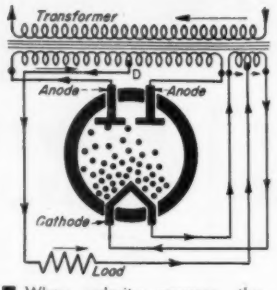
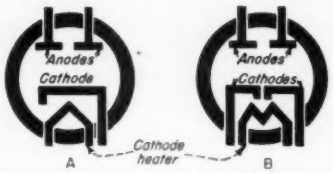


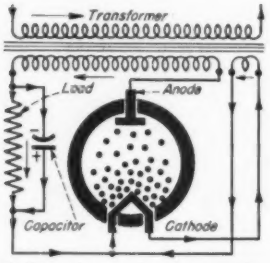
6 With this transformer polarity the right-hand anode conducts



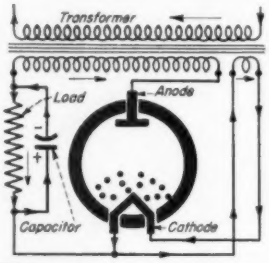
7 When polarity reverses, the left-hand anode will conduct



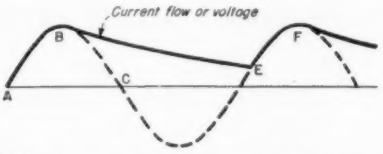
8 Duplex tube in A has an indirectly heated cathode, whereas B has two cathodes and anodes



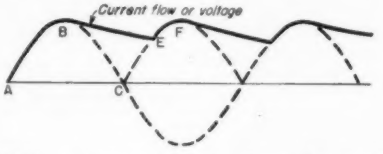
9 The tube supplies power to the load and charges the capacitor



10 On reverse polarity, capacitor maintains current flow to load



11 Current or voltage curve, with capacitor used as a filter to maintain the current and voltage



12 The solid curve shows the current flow or the voltage in full-wave circuit that is filtered

and may be represented by wave *ABC*, Fig. 1*b*.

During alternation, *CDE*, Fig. 1*a*, voltage on the transformer and tube is reversed, as in Fig. 3. Here current flows through the cathode opposite to that in Fig. 2. As mentioned, this makes no difference in tube operation as the only function of this current is to heat the cathode. The anode, however, has been given a minus polarity, the same as the electrons. Then, instead of the anode attracting the electrons, as in Fig. 2, it repels them and current cannot flow through the tube. Therefore, during the ac wave *CDE*, no current flows in the dc circuit as during the period *CE*, Fig. 1*b*.

During the next ac wave *EFG*, Fig. 1*a*, conditions become the same as *ABC*, and current again flows in the dc circuit, Fig. 2. From this we see that the tube lets current flow during each half cycle to the dc circuit. As a result, current flow in this circuit is a series of waves with a period between them when no current flows, Fig. 1*b*. This is known as half-wave rectification and is used where only small power is rectified.

Full-Wave Rectifiers. To rectify both halves of the cycle two tubes are connected, as in Fig. 4 and 5. Small sections of the transformer secondary winding connect to the cathodes to heat them. With the transformer polarity, Fig. 4, tube *A* anode has minus polarity and current cannot flow through it. Anode of tube *B* has plus polarity and conducts current from cathode to anode and through the external load as indicated by arrowheads. Assume operation to be during period *ABC*, Fig. 1*a*, which can be represented as in Fig. 1*c*.

During period *CDE*, Fig. 1*a*, voltages applied to the circuits are reversed, Fig. 5. This gives tube *B* anode minus polarity so current cannot flow through it. Anode of tube *A* has plus polarity and conducts in the same direction through the load as in Fig. 4. In this way we have made the *CDE* half of the ac cycle active, and in the same direction as *ABC*, Fig. 1*c*. Load current thus flows in a series of waves in the same direction, known as full-wave rectification.

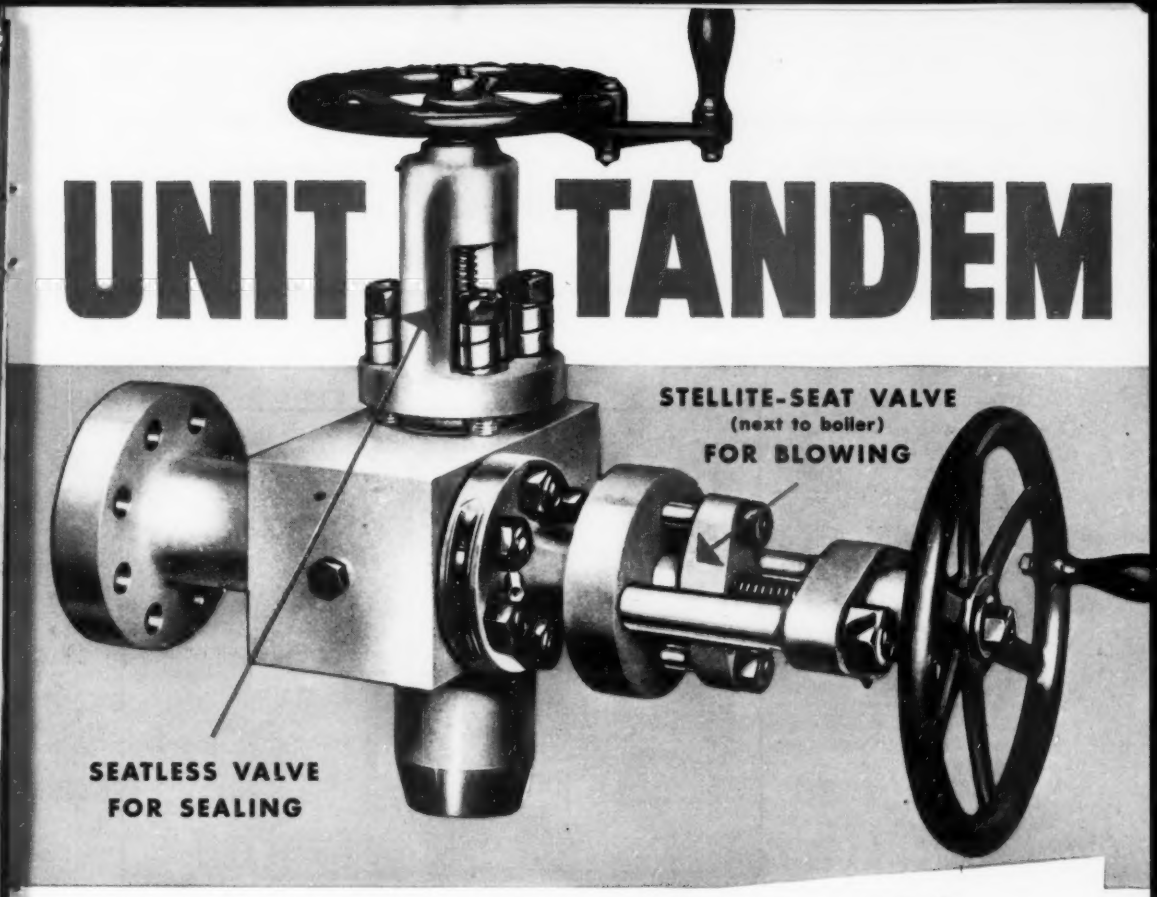
Duplex Tubes. Fig. 2 to 5 show the simple fundamental circuits for half-wave and full-wave rectification, using single high-vacuum tubes with directly heated cathodes. Sometimes, where small-power full-wave rectification is required, a duplex tube (one with two sets of elements) is used. When such a tube has a directly heated cathode it has two anodes and one cathode, Fig. 6 and 7. Fig. 8*A* shows a double-anode tube with an indirectly heated cathode. When the tube has two indirectly heated cathodes and two anodes the heaters are generally connected in series within the tube, Fig. 8*B*.

Fig. 6 and 7 give simple rectifier connections for double-anode tubes and indicate current flow in the circuit for one half-wave operation. In Fig. 6 the load taps to the center of the cathode-heater section of the transformer winding. This gives the same voltage in each half wave of rectified current.

At the instant represented in Fig. 6, load current flows from tap *D*, at the center of the main transformer winding to the center tap on cathode-heater section of the transformer; then through the left-hand half of the heater transformer, the right-hand side of the cathode, the right-hand anode, and to the main transformer, as indicated. On the next wave of ac power, voltage reverses in the transformer and the load current flows from tap *D* through the load, right-hand half of the heater transformer, the cathode, left-hand anode, and to the

(*Continued on page* 160)

UNIT TANDEM



YARWAY'S Answer to High Pressure Blow-Down Requirements

As pressures increase, so does the demand for dependable blow-off valves to meet these needs.

The Unit Tandem is Yarway's answer . . . proved by hundreds of successful high pressure installations in leading utilities and industrial plants.

This blow-off valve, combines the worth-while improvements and advances both in metallurgy and mechanical design.

Unit Tandems are built for pressures to 2500 psi.

Inside (next to boiler) blowing valve is the Yarway Stellite-Seat valve.

Outside sealing valve is the famous Yarway Seatless design which has no seat to score, wear and leak. This valve is always opened first and closed last, maintaining a tight seal at all times.

Write for Yarway Bulletin B-432 for complete description of this Unit Tandem. For lower pressures ask for Bulletin B-424.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Penna.

YARWAY BLOW-OFF VALVES

POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

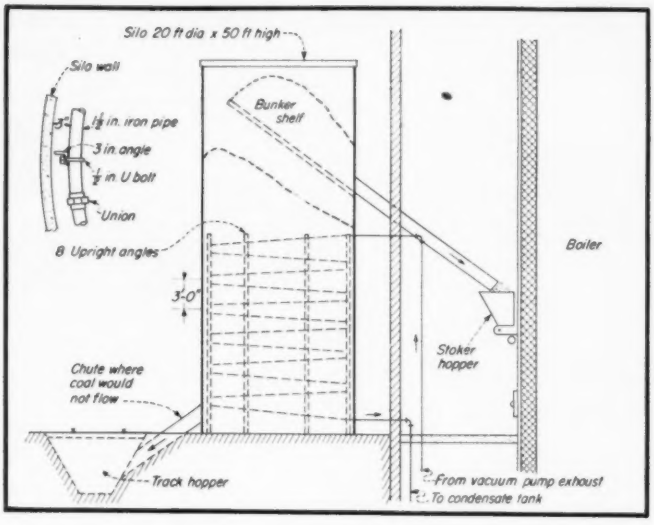
AUXILIARY EXHAUST STEAM PREVENTS COAL FREEZING

WE HAVE TWO SILOS each feeding directly into a boiler stoker hopper. During severely cold weather coal often freezes in the lower portion of the silo, blocking its flow down the chute into the track hopper. We have eliminated this trouble by installing an iron-pipe coil inside the silo, as shown in the sketch at right. The coil is made up of prebent 20-ft lengths of 1½-in. black-iron pipe, painted and assembled with unions on each end.

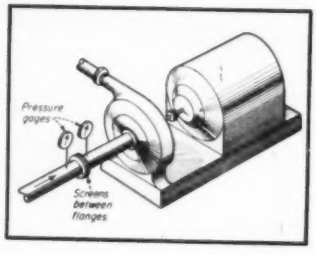
The coil makes up in the form of a helix, with a vertical distance of about 3 ft between turns, and is supported by U-bolts clamped to eight angle-iron uprights. Steam, from the exhaust of the reciprocating vacuum pumps on the plant return system, enters the top opening of the coil. Condensate returns to the plant's condensate storage tank. Keep the coil at least 3 in. from the silo wall to prevent trapping 1-in. coal.

P M VAN WINGEN

Grand Rapids, Mich.



SUCTION SCREENS PROTECT PUMP DURING FIRST START



IN THE PAST when starting up pumps in a new piping system we have experienced considerable trouble with abrasive matter such as scale, sand and the like getting into the pumps. It seems residual foreign matter remains despite best efforts to keep pipe interiors clean during assembly.

We recently placed in service some additional new piping and pumps. To protect the latter we placed screens between the pipe flanges as close to the pump suction nozzle as possible. A flat screen of 1/32-in. mesh was placed on the upstream side, which was backed up on the downstream side by ¼-in. hardware cloth. Pressure gages were tapped into the line on both sides of the screens so pressure drop through the screens could be measured by subtracting gage readings.

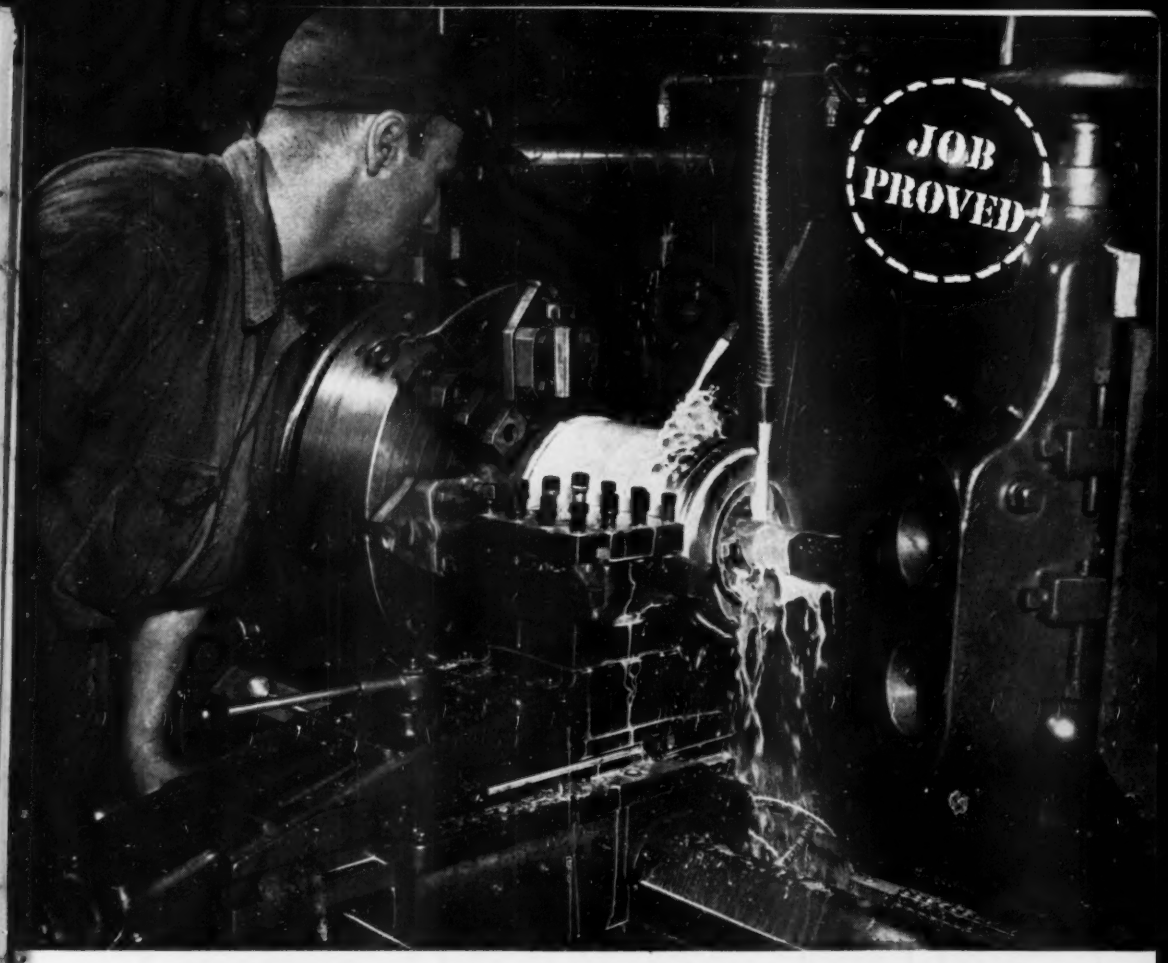
When initially starting a pump the gage readings were carefully followed. An increasing pressure difference indicated the screen was becoming clogged with dirt and scale. As soon as such increasing pressure drop was noted, the unit was shut down, the screens removed, thoroughly cleaned and then replaced. Usually after the first cleaning, no more foreign material collected on the screens and it was safe to assume that the piping was clean. The screens in each case were continued in service for 24 hours before they were permanently removed from between the pipe flanges.

JOHN R BROWN *Bauta, Cuba*

(Continued on page 132)

The Editors Invite Contributions From POWER Readers

Here's your chance to cash in on one of those professional tricks you have used in your plant. POWER pays $20 for each item published here on problems in design, operation and maintenance. Your contribution need be in rough form only—just set down all facts with sketches in pencil. We will do any editing that is needed.



MAKING THE BIG CHIPS FLY!

Sunoco Emulsifying Cutting Oil Is Used for Rough-Finishing of Heavy SAE 3140 Forgings

The correct cutting fluid is a big factor in the continuous heavy-duty machining of tough steel forgings on the machine shown above.

Machine: Warner & Swasey 4-A Heavy-Duty Turret Lathe

Material: SAE 3140 Forging

Operation: Roughing-Out Cap for Pile-Driving Machine

Cutting Fluid: 1 part Sunoco Emulsifying Cutting Oil to 20 parts water

Sunoco Emulsifying Cutting Oil is a viscous, self-emulsifying oil that quickly and easily forms a stable emulsion with water. It contains no animal or vegetable fats, and will not turn rancid.

Sunoco Emulsifying Cutting Oil meets the demand not only of tough cutting jobs, but also of a wide range of turning, milling and grinding operations calling for close tolerances and fine finishes. It is particularly efficient where precision machining at high cutting speeds is demanded.

For full information, for samples to test on your own machines, for the services of a cutting oil specialist, call your nearest Sun office. Or write Department P-2.

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SUN PETROLEUM PRODUCTS

"JOB PROVED" IN EVERY INDUSTRY

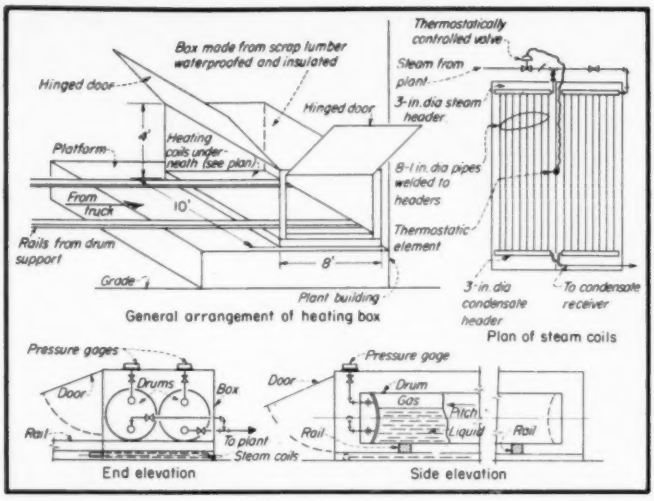
SUNOCO

HEATING BOX AIDS RAPID REFRIGERANT TRANSFER

SULPHUR DIOXIDE, Freon 12 and methyl chloride can be transferred quickly from the shipping drum to plant system by applying a small amount of heat. But using steam hoses, hot water or gas flames is dangerous. Controlled application of heat is necessary for safety.

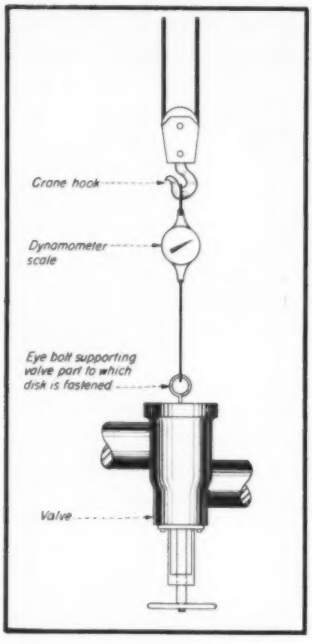
Sketch at right shows the essential layout of a method for safe transfer. An insulated wooden box, 10x8x4 ft, mounts on a platform outside the plant so drums can be rolled off the delivery truck into place. Two drums, each holding one ton of refrigerant, can be heated simultaneously.

One steam coil for each drum supplies heat. Coils are made of eight 1-in. pipes connected between headers. The thermostatic element between the drums closes the steam valve when drum temperature reaches 120 F. Temperature must be accurately controlled because the fusible plugs in the drums melt at 165 F. Drums are pitched toward outlet valve to aid rapid drainage. Of two permanent lines in the box, one connects drum gas valve to pressure gage, while the other connects drum outlet to the system.



Transfer procedure is (1) roll drum in place (2) make pipe connections (3) open transfer-line valves (4) turn steam into heating coil (5) watch pressure gage for indication of complete drainage. This layout has given complete satisfaction in practice.

TYLER G HICKS *New York, N. Y.*



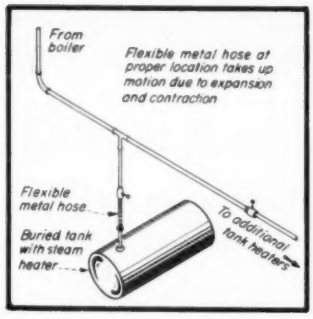
How a Measured Pull Solved Our Problem in Valve Grinding

WE RAN INTO TROUBLE while grinding the seat of a 10-in. turbine throttle valve. The metal of the seat and disk pulled during grinding. They are of the 45-deg beveled type made of monel metal. The valve part holding the disk weighs about 250 lb. We discovered that the pulling was caused by the high-contact pressure between seat and disk. To reduce this pressure the valve part carrying the disk was suspended from the crane hook with a dynamometer scale inserted in the cable as shown in the sketch at left.

The disk assembly was placed in the body and the pressure adjusted by taking up on the crane hook until the dynamometer scale showed about 220-lb lift. This gave a weight of about 30 lb, which proved to give the correct grinding pressure.

The same procedure has been used on several other large valves in our plant with very satisfactory results. To make the necessary close adjustment, fine crane control is needed. Cable lengths should be chosen so scale can be easily read from working position.

E L FAUTH *Quarryville, Pa.*

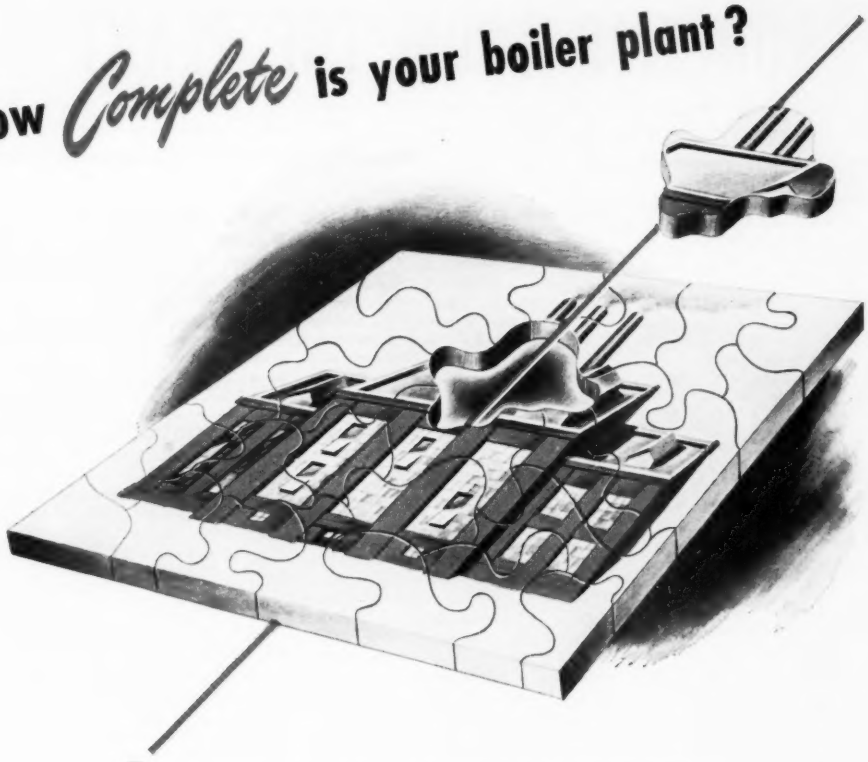

From boiler
Flexible metal hose at proper location takes up motion due to expansion and contraction
Flexible metal hose
Buried tank with steam heater
To additional tank heaters

Flexible Metal Hose Adjusts For Expansion Without Strain

IN TIGHT PLACES where only a short run of steam pipe is needed we have found that a flexible metal hose will take care of expansions without strain on piping and pipe joints. Besides eliminating the headache of figuring a loop design for cramped conditions, we have found the metal-hose installation to be more economical in first cost of labor and material.

A B HAFNER, JR *Philadelphia, Pa.*

How *Complete* is your boiler plant?



Insofar as mechanical equipment is concerned, a boiler plant may be complete in every respect. However, completeness of equipment will not necessarily assure most efficient operation of the system. An adequate and well controlled program of boiler water treatment, too, is highly important. A water conditioning engineering service should be an integral part of your picture. We ask, "how *complete* is your boiler plant?"

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water conditioning problems relative to boiler feedwater . . . cooling water . . . air conditioning . . . industrial waste treatment. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical. Whatever your particular water conditioning requirements, our staff of engineers is ready to serve you. W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa. In Canada—BETZ Laboratories Limited, Montreal 1.

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BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

PROBLEMS FROM THE PLANT

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

HOW CAN WE REMOVE TURBINE-BLADE DEPOSIT?

WE ARE PLANNING to install a new 2000-kw steam turbine in our plant, and want to organize maintenance procedure well in advance of actual operation. New unit is designed to operate at 600 psig, 825 F. It will exhaust to a condenser at 2-in. of mercury (absolute backpressure).

Preliminary water tests show extensive treatment will be needed for water make-up, and hence frequent removal of chemical deposits is anticipated.

We would appreciate hearing of practical methods now being used by POWER readers to remove deposits from turbine blades, nozzles and valves. Desuperheater piping details, washing procedure and tests to tell when the job is finished would be of very great help.—*ME*

READERS' ANSWERS

What Is Best Way to Move Smoke Stack?

(This question is from November issue with best answers from readers.)

A POWER ENGINEER *runs into all kinds of jobs that are off the beaten path. For instance, something we never met up with before is moving a smoke stack a distance of six feet. Here are details:*

We plan to install a new boiler, and to do so we have to move an 85-ft steel smoke stack laterally a distance of six feet. As shown in the sketch [see POWER, *Nov, p 114] *to the left, the stack has a base diameter of 78 in., and weighs approximately 7 tons. An octagonal brick base, which has an 8-ft diagonal, surrounds the lower part of the stack. We estimate that the weight of this base is 30 tons.*

The stack and base are supported on a 10x10x4-ft concrete foundation that weighs approximately 30 tons. The foundation surface is level with the surrounding ground. We are hoping to move the stack, base and foundation as a complete unit.

In thinking over various ways to handle the job, we believe that our first step should be to set up guy lines from a ring near the top of the stack to nearby buildings. We then plan to fasten another set of guy lines from about midway on the stack to adjoining buildings. We think next best step is to undermine foundation ends and place H beams under each end. From beam ends we plan on chain slings to another parallel set of H beams, placed on rollers above. We may have to build a supporting concrete base on either side of the foundation for the roller ends. From shackles on the top H beam's ends, a system of pulleys could be rigged, and stack, base and foundation moved as a complete unit. It will be necessary to relocate the rollers placed under H beam as unit moves.

All this sounds good, but since we have never handled such a moving job we are not sure about possible complications.

Perhaps some of POWER's *readers have met a similar problem and will be able to help us outline a good procedure for handling the job.*—WA

Pour New Foundation First

WA's STACK-MOVING SUGGESTIONS, while effective, involve too much work. Past experience with similar moving jobs shows method illustrated in sketch at lower left is most practicable.

First guy stack to buildings, then excavate to left or right of foundation, depending on direction of movement. Insert dowels in existing foundation and pour concrete for new extension. After breaking away brick base, move stack to new foundation using rollers and portable crane.

WA can estimate cost by figuring $20 per cu yd of concrete installed, and $75 a day crane rental. By accurate planning the crane will be needed for only one day.

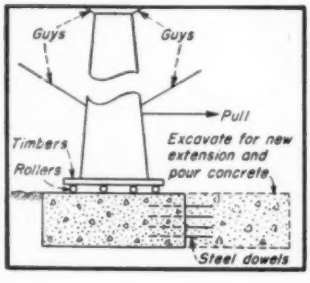
TYLER G HICKS *New York, N. Y.*

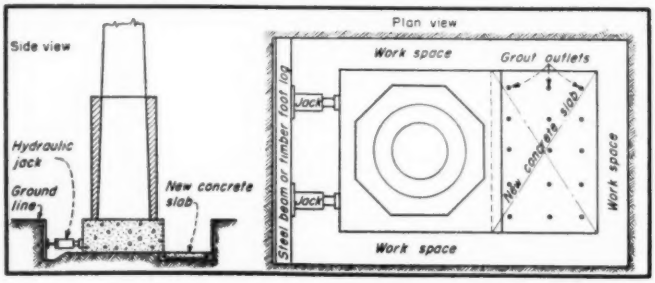
Slide on Concrete Slab

WA's STACK MAY BE MOVED safely and easily by following the sketch at lower right. First excavate on opposite sides of the foundation, then lay a 12-in concrete slab under foundation edge. Reinforce slab with bars laid parallel and perpendicular to line of travel. Build grouting pipes into slab with their outlets turned up, allowing one for each 6 sq ft.

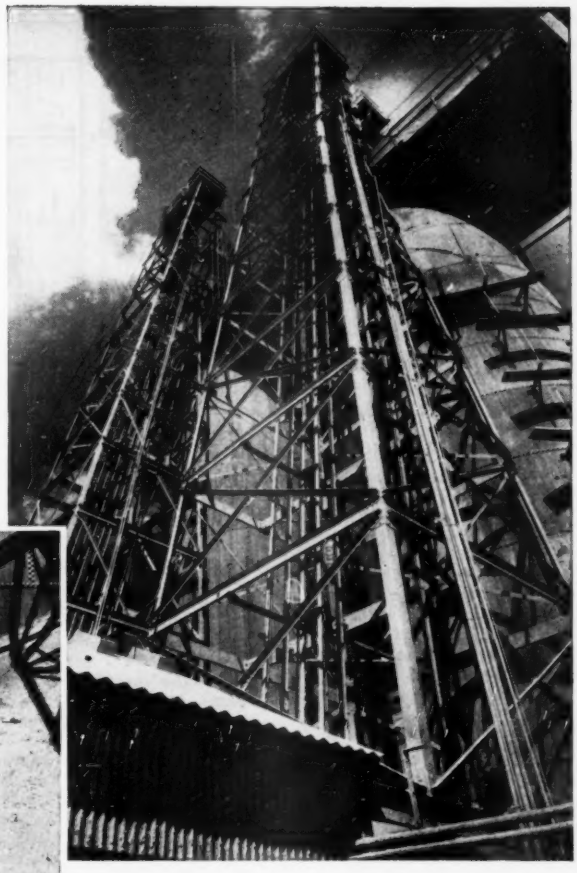
Dig excavation opposite slab below bottom of foundation if earth is not firm. Type of soil determines steps in providing solid blocking for jack's bases. Foundation soil and smoothness of concrete bottom help determine force necessary to move stack. This force will probably not exceed 60 to 75% of weight moved. Free foundation sides from earth before moving stack.

If foundation is on solid clay, elim-



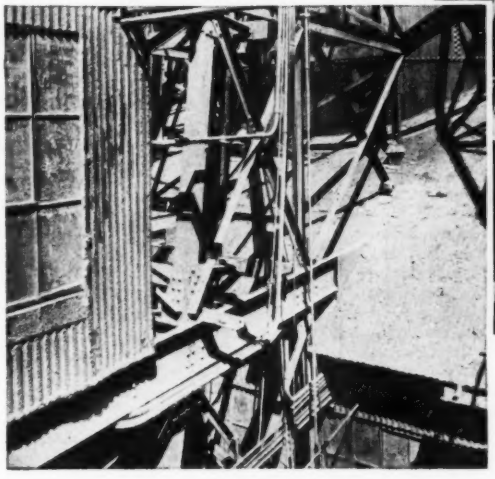


More than 4300 pounds of Everdur Electrical Conduit are required to carry power lines to operating machinery at the huge Columbia lime kilns at Barberton, Ohio. Conduit for this installation was supplied by the Hardware & Supply Co., Anaconda distributors of Akron, Ohio.



In operating limestone kilns...

EVERDUR CONDUIT fights corrosion, gives superior service



AT THE BARBERTON, OHIO, limestone kilns of the Columbia Chemical Division of the Pittsburgh Plate Glass Company, corrosion is an ever-present enemy of the power lines that feed the operating machinery.

After failure of various other types of conduit, the Purchasing Engineer specified Everdur* Rigid Conduit. He reports, "We are satisfied that Everdur Conduit is a long-run economy and the solution to this particular problem."

Everdur Copper-Silicon Alloy Conduit possesses high strength, is non-magnetic, workable and weldable. It is available in two wall thicknesses; rigid conduit (RC) in nominal sizes from ¼" to 4" inclusive, and the thinner-walled electrical metallic tubing (EMT) in nominal sizes ⅜" to 2" inclusive. Complete lines of fittings...connectors, couplings, outlet boxes, etc....are available in Everdur Alloys from leading manufacturers.

*Reg. U. S. Pat. Off. 49226

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ELECTRICAL CONDUIT

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General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

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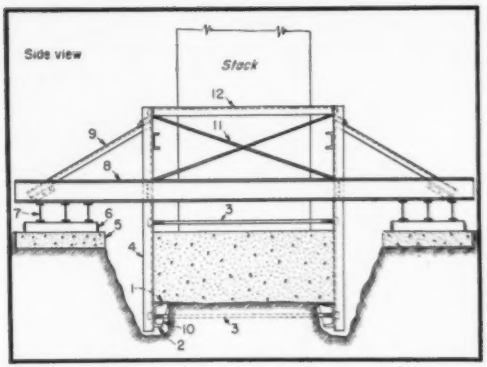
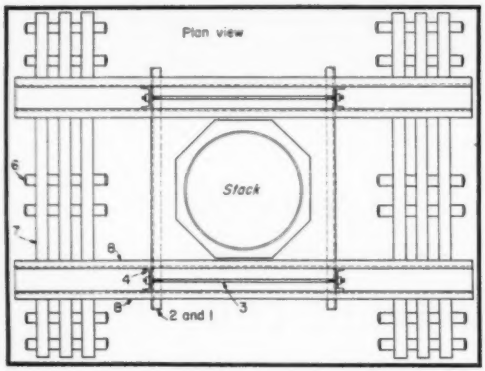




inate slab and put a bent-up steel shoe under front edge of foundation.

One set of guys fastened near top of stack are a good safety measure, but are not needed if earth is firm and work done carefully. Center of gravity of stack, base and foundation is about 33.5 ft above foundation bottom. Use guys if steel stack is not firmly anchored to concrete foundation.

After moving stack to new position, force grout between foundation and new slab.

IRA A BUTCHER *Piney River, Va.*

Support With Steel Plates

WA's FIRST STEP is to construct a new concrete foundation with one end turned up. Fit the turned-up end to accommodate 1½-in. dia pull bars. Then place H-beams on rollers so beams are parallel to axis of motion. Run two more beams perpendicular to these so the final effect is an H-beam ring around stack.

Secure stack to beams by welding a series of ½-in. steel plates at an angle between all H-beams and steel stack. Weld steel plates at all points where they touch stack and beams. Next step is to install four guy wires. Best bet in this direction is use of an endless guy line. This is nothing more than an ordinary line where both ends are fastened to stack with a winch between.

While thus supported, burn off stack base close to foundation. Most likely, stack has riveted angle piece and is set in the concrete foundation; burn off stack just above this angle. *WA* is now free to move stack with the help of hydraulic jacks. The pull bars through turned-up end of new foundation are used after stack is jacked a foot or so.

WA may be able to use the old foundation stack ring in the new location by simply moving and welding it in place after stack is moved.

H WILKINSON *Victoria, B. C.*

Build Steel Truss

TO GET GOOD FOOTING, *WA* should pour two concrete slabs, 5, sketch left above, one on each side of stack in direction of travel. Then dig around foundation side and slightly under it to install the two threaded tierods, 3. Item 2, a channel extending full length of foundation, is the member on which foundation load is carried. It is necessary to reinforce this member with steel plates, 1, on both flanges as well as gussets, 10, between flanges, as shown in above sketches.

Channel 4 connects between a pair of other channels, 8. Channels 8 then rest on I-beam 7. These I-beams ride on top of rollers, 6, which in turn move along concrete slab 5. Members 9, 11 and 12 are structural parts forming a truss. Note there are two tierods above foundation and two below.

Most members could be prefabricated, drilled and bolted together or, if desired, the whole assembly could be welded.

After whole structure is assembled, place hydraulic jacks under 8 and raise sufficiently to set rollers. Use enough guy wires to steady the stack with turnbuckles, to let out and take up slack in the cables while stack is moving.

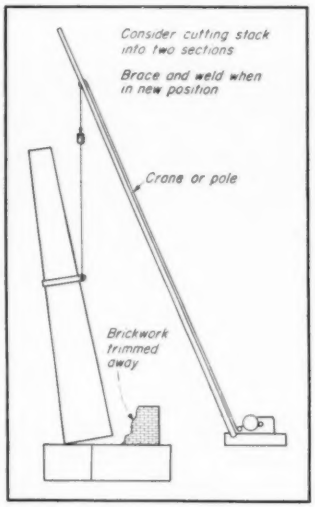
P M VANWINGEN *Grand Rapids, Mich.*

Adopt Sliding Ways

TO MOVE *WA's* chimney I would adopt the sliding ways used for ship launching and use wedges to lift load evenly. Surveyor's transit will check stack for plumb. Actual move can be handled smoother with jacks and blocking than with cable and pulleys.

Prepare solid foundation for stack's final resting place. Hold stack in place with guys while foundation is completed.

N A HELMER JR *Plainfield, N. J.*



Lift Stack With Crane

AFTER CHECKING STACK to see if it can be moved, *WA* should lay a new foundation by adding 6 ft to present one. Steel-concrete reinforcement is probably necessary. After curing new foundation for a week or so, remove brick base to about one half its height.

Hold stack with a portable crane while knocking down rest of brick base on side *WA* wants to move. Check if stack bottom has flange bolted to the foundation. If so, take down all brick before hiring crane. Move as shown in sketch above.

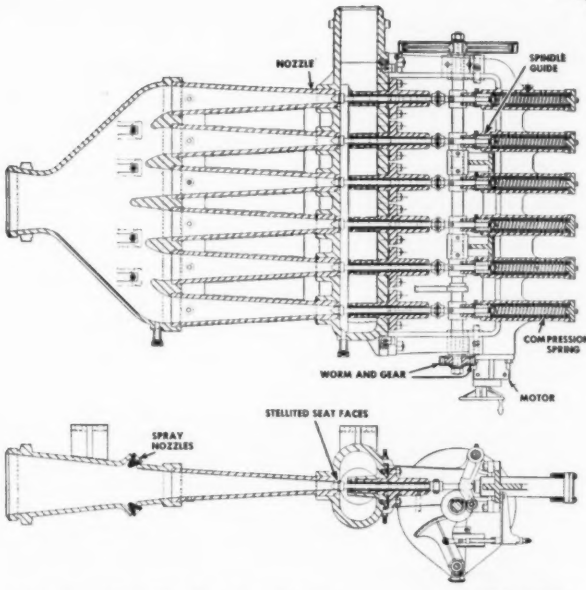
Where crane is not available, rig up a pole for the job. Any reliable rigger can handle this. If stack cannot be moved in one piece, cut it in two; brace and weld in place after moving.

GEORGE GRIFFEL *New York, N. Y.*

(*Continued on page 166*)

an ƒ "reason why"

engineered to bridge a gap



A large public utility had a problem . . .

In bridging a gap . . .
From a high pressure steam source . . .
To low pressure turbines.

An ƒ Reducing and Desuperheating Valve . . .

Bridged the gap . . .
Solved the problem.

In operation, it reduces steam pressure . . .

From 1300 psi gauge to 215 psi gauge . . .
And desuperheats steam . . .
From 950° F.T.T. to 500° F.T.T. . . .
While supplying 1,000,000 pounds per hour.

This Multi-nozzle Reducing, Desuperheating Valve . . .

Performs efficiently . . .
Operates quietly . . .
Regulates accurately . . .
Controls smoothly . . .
Requires little maintenance.

It's an outstanding example . . .

Of Schutte and Koerting's ingenuity . . .
In designing and building a product . . .
To meet a requirement.

SCHUTTE and KOERTING Company

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JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT • ROTAMETERS AND FLOW INDICATORS RADIAFIN TUBES • VALVES • SPRAY NOZZLES AND ATOMIZERS • GEAR PUMPS

NEW PLANT EQUIPMENT

Pressure-Reducing Valve E80

HIGH-PRESSURE reducing valve, Class *HS*, employs internal pilot piston construction and is designed for steam, air or gas service. It handles inlet steam pressures from 300 to 1500 psi, and inlet air or gas pressures from 300 to 3000 psi. Reduced pressure range is from 100 to 600 psi. Maximum inlet temperature is 1000 F. Valve has a cast chrome-moly steel body with integral *stellited* seating surface. It is available in sizes 1, 1¼, 1½ and 2 in. with Series 90 or 150 flanges or welding ends. No change of spring or diaphragm is needed from minimum to maximum reduced-pressure setting.

Valve is single seated, closing with the inlet pressure for positive dead-end shut-off. Manufacturer says accuracy of regulation is comparable to instrument control. Interchangeability of replacement parts makes a complete overhaul possible without removing body from the pipeline. Main valve is hardened stainless steel with stellited seating surface. Controlling valve is solid stellite. Cylinder liner and piston are made of hardened stainless steel, highly ground finish. Valve has a Monel diaphragm. Valve has no stuffing boxes. To eliminate the effect of turbulence and pressure drop at outlet body throat, an external control-pipe connection for reduced pressure is furnished. **Leslie Co, 50 Delafield Ave, Lyndhurst, N. J.**

Gearless Pump E63

DUAL ECCENTRIC PISTON, to give strong flow against pressure, makes this pump suitable to handle a wide range of liquids and viscous fluids. Pump body made of naval-bronze or stainless-steel castings. Eccentric made of resilient compounds. Available in ¼-, ⅜-, ½- and ¾-in. sizes for capacities of 1 to 12 gpm. Pumps used for pressures from 0 to 100 psi, and speed of 200 to 2100 rpm. **Eco Engrg Co, 12 New York Ave, Newark 1, N. J.**

Magnetic Separator E65

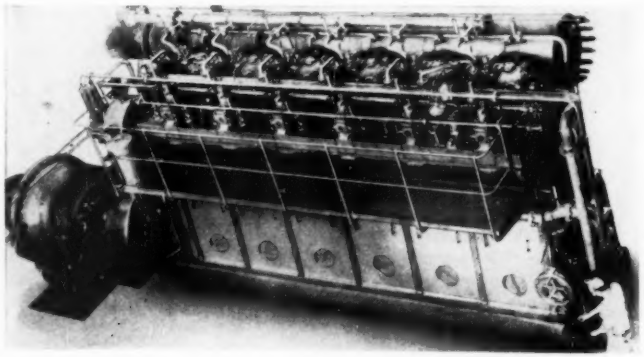
DEEP-BURDEN rectangular electromagnet removes tramp iron from heavy burdens of material on belt conveyors or passing down chutes. Magnet developed specifically for removing tramp iron from coal on 42-in. belt delivering 1000 tons per hr, where magnet could not be set closer than 18 in. from the belt. Magnet installed over conveyor belt, spouts or chutes where heavy burdens and fast belt speeds make it impossible to use standard magnetic separators. Protects crushers, grinders, pulverizers, stokers and other machinery. Prevents fires and explosions caused by tramp-iron sparks in dust-laden atmospheres and removes iron from coal, rock, slag and nonmagnetic ores. **Dings Magnetic Separator Co, 4740 W McGeogh Ave, Milwaukee, Wis.**

Magnetic Starter E88

DESIGNED FOR STARTING and protecting motors up to 50 hp, new full-voltage starters are furnished in NEMA sizes from 0 through 3. Contactors can be furnished in NEMA sizes from 00 through 3.

Coil is wrapped in a one-piece plastic-encased enclosure, protecting windings against dirt, moisture or possible damage during installation. Self-lubricated vertical slots inside enclosure permit magnet armature guides to move smoothly.

Silver contacts are easy to inspect, change and remove without using special tools. Arc shields, of cold-molded asbestos, prevent arc-over between contacts. **General Electric Co, Schenectady 5, N. Y.**



Dual-Fuel Engine E71

DESIGNED FOR OPERATION on low-pressure gas with extremely low pilot-fuel requirements, 2-cycle, 21½x27½-in. dual-fuel engine is described as first large loop-scavenging engine to work satisfactorily on low-pressure gas-injection principle. Change-over from gas to oil and from oil to gas is fast and easy. Fuel consumption is good throughout entire load range, builder reports, and combustion is complete and quiet.. Pilot-oil rates as low as 8.3 lb per hr per cylinder have been observed under test at 90% load.

When arranged for dual-fuel operation, engine is rated at 425 hp per cylinder at 240 rpm, on either gas or oil. This is net rating at 100% load and includes blower requirements. In performance, maintenance and control, builder reports, no perceptible difference appears between dual-fuel and straight diesel operation.

Based on the Hamilton series 21-SA 2-cycle diesels, the new engine is available with 5 to 10 cylinders. A rotary valve has

Use convenient reply cards on page 196a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, E, and number, as shown on the items above.

If it's power piping equipment it's in the CRANE line

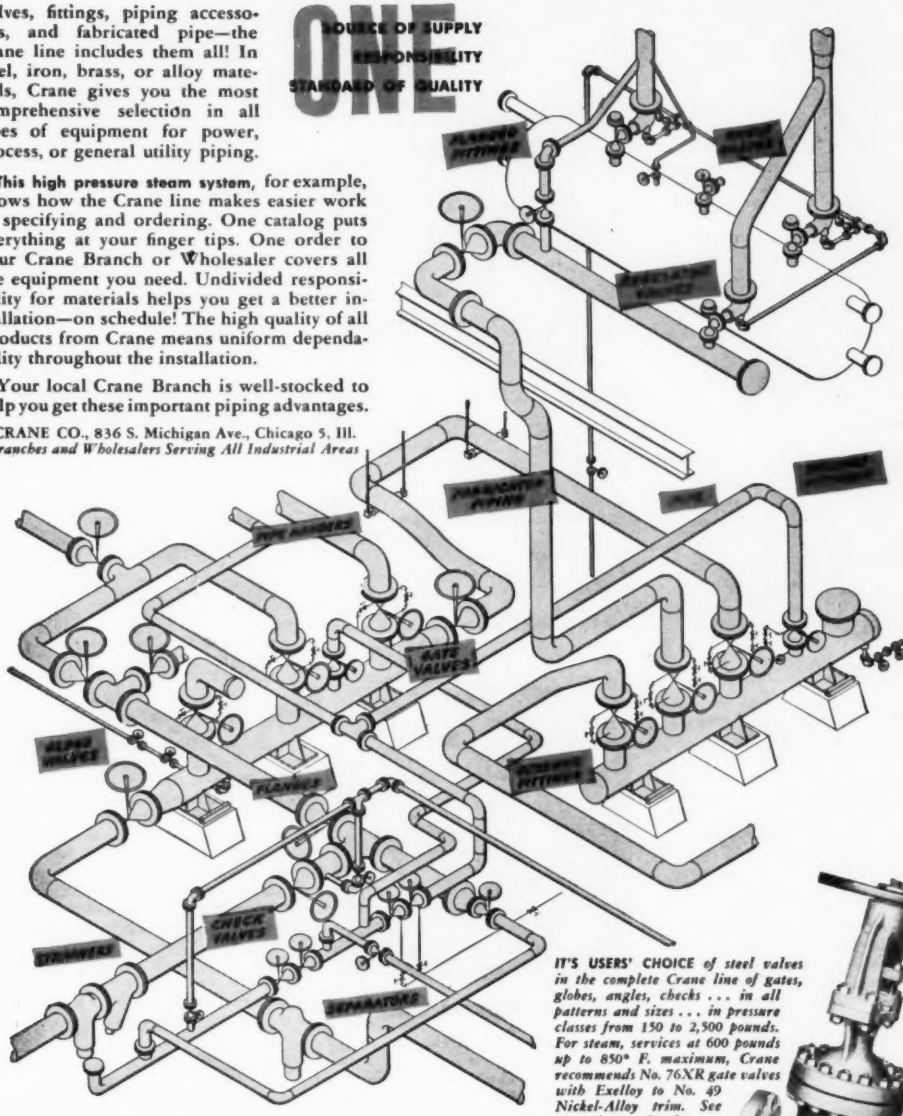
Valves, fittings, piping accessories, and fabricated pipe—the Crane line includes them all! In steel, iron, brass, or alloy materials, Crane gives you the most comprehensive selection in all types of equipment for power, process, or general utility piping.

ONE SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

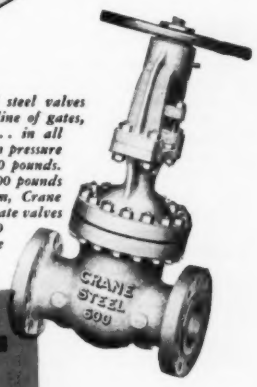
This high pressure steam system, for example, shows how the Crane line makes easier work of specifying and ordering. One catalog puts everything at your finger tips. One order to your Crane Branch or Wholesaler covers all the equipment you need. Undivided responsibility for materials helps you get a better installation—on schedule! The high quality of all products from Crane means uniform dependability throughout the installation.

Your local Crane Branch is well-stocked to help you get these important piping advantages.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



IT'S USERS' CHOICE *of steel valves in the complete Crane line of gates, globes, angles, checks . . . in all patterns and sizes . . . in pressure classes from 150 to 2,500 pounds. For steam, services at 600 pounds up to 850° F. maximum, Crane recommends No. 76XR gate valves with Exelloy to No. 49 Nickel-Alloy trim. See your Crane Catalog.*



EVERYTHING FROM . . .

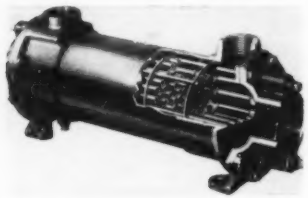
VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

been added in the exhaust outlet, which, in conjunction with the loop-scavenging principle, enables the cylinder to trap nearly 40% more air with a proportional increase in power output. Alterations to clearance volume and cooling principles make possible a material increase in power output while still maintaining a conservative rating.

Control of inlet-air temperature is maintained by a cooler between scavenging blower and engine, the cooler having sufficient capacity to hold air temperature constant under extreme ambient variations. Gas injection, closely metered, starts as exhaust ports close, compressing gas with trapped air. Gas pressure in main manifold is varied in direct proportion to engine load, as is amount of scavenging air. A number of safety devices, including quick-closing valves in each cylinder and an underspeed governor, eliminate possible hazards of gas operation. **Lima-Hamilton Corp, Hamilton, Ohio.**



Heat Exchanger E54

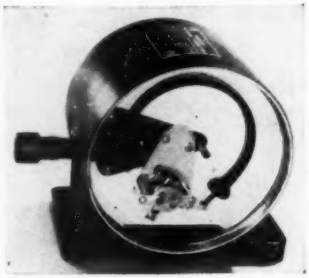
LIGHTWEIGHT nonferrous heat exchanger employs brass forgings instead of castings for bonnets and hubs in the smaller sizes. Tubes are roller expanded into place to give a tight fit. All tubes are straight to facilitate cleaning. Baffling is transverse to give cross flow across tube surface. **Ross Heater & Mfg Co, 1407 West Ave, Buffalo 13, N. Y.**

Welding Rod E53

GRAY AND ALLOY CAST IRON can be welded at low currents to give a low heat weld. Resulting weld has high tensile strength and strong bonding, says the maker, and is thoroughly machinable. *EutecTrode* 24/49 applies quickly with ac or dc, either straight or reverse polarity. Rod comes in 3/32, 1/8 and 5/32 in. dia. **Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y.**

Turbine-Pumping Unit E68

MOTOR AND PUMP COMBINED into one assembly to form turbine-type pumping unit that fits into small floor space. Built in capacities of 2 to 10 gpm. Pump has replaceable heads and impeller to facilitate repairs and permit changing capacity if needed. Mechanical seals eliminate packing. In three standard constructions, bronze-fitted, all-iron and all-bronze, they are available with a single-phase, 110-220-v, 60-cycle capacitor, ball-bearing motor and stainless-steel shaft. **Roy E Roth Co, Rock Island, Ill.**



Pressure Transmitter E94

PRESSURE MOTION is picked up from tip of bourdon tube and by electro-mechanical relay. Motion is converted into dc signal, which may be indicated or recorded with milliampere or millivolt instruments. Electrical output is directly proportional to movement of bourdon tube, making possible use of a uniformly graduated scale.

Normal operating voltage is 115 v at 50-60 cycles. Standard units measure pressure up to 50,000 psi. **Manning, Maxwell & Moore, 11 Elias St, Bridgeport, Conn.**

Watthour and Demand Meter E85

DESIGNATED as Type *IHM*-1 the single-phase combination watthour and thermal demand meter is suitable for industrial use. It may be installed wherever rate structures require measurement of demand as well as energy, without increasing original meter installation size.

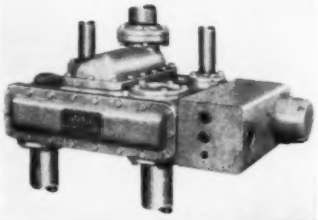
New damping system and electromagnet, as used in the I-50 watthour meter, is adopted in this new design. **General Electric Co, Schenectady 5, N. Y.**

Repair Cement E58

CORROSION-RESISTING repair cement, *Carbo-Fix*, results from a polymerization between special fluids and powders. Applied in a paste-like form to metals, it is claimed to (1) resist temperatures up to 350 F, (2) withstand usual concentrations of acids, solvents and alkalies. **Carbo'ine Co, 7603 Forsythe Blvd, St Louis 5, Mo.**

Chain Vises E66

EQUIPPED WITH FORGED-STEEL JAWS, these vises simplify taking apart roller chains by securely holding the chain while pins are driven out with a drift. Vises have jaws so shaped that pin link to be removed has a firm seating on the jaw edges. They are easily adjustable to fit changes within their range. Vise No. 1 holds single roller chains from ½- to 1-in. pitch and D-40 and D-50 double-width chains. Vise No. 2 holds single-width chain from 1- to 2-in. pitch, and double-width from D-80 to D-160. **Baldwin-Duckworth Div, 369 Plainfield St, Springfield 2, Mass.**



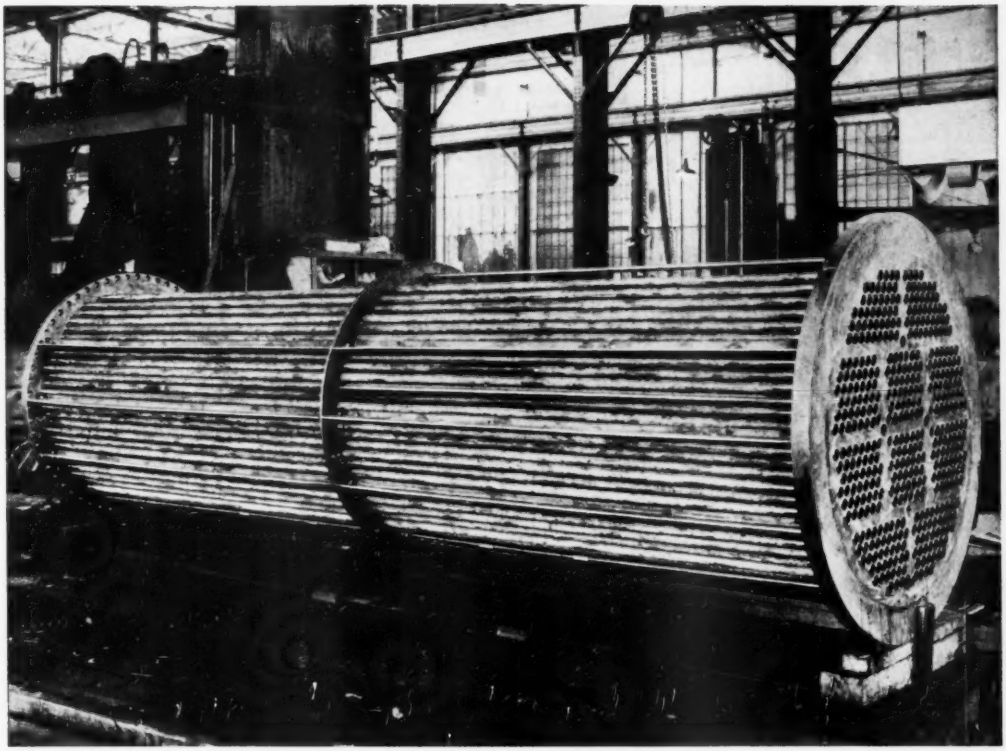
Control Valve E75

SWING-OVER VALVE is suitable for remodeling old softeners and filters as well as for new installations. Device completely eliminates the rubbing rotor, high-pressure loss and sticking plugs. Operation is free from water hammer. Features include interchangeable seats and disks. Valve has no rubbing surfaces to rub or wear and uses only one stuffing box. Operation requires only a single 1/20-hp motor because water pressure is employed to help open its cam-operated poppet system that is closely patterned after the valve design of internal-combustion and uniflow engines. **Belco Industrial Equipment Div Inc, 42 Iowa Ave, Paterson 3, N. J.**

Rotary Joint E82

IMPROVEMENTS to the new Type *S* permit its use on higher temperatures up to 600 F and pressures up to 150 psi. Unit provides inlet flow of steam to rotating cylinders and outlet of condensate. A similar Type *P* provides one passage only, and is installed at each end of a revolving drum. One end of rotary joint screws into end

Use convenient reply cards on page 196a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.



ELECTRICITY CAN BE CORROSIVE, TOO

OPERATORS of condensers are well-informed and follow sound general practices that should result in satisfactory tube life, but it has been estimated that in about 90% of American plants there is at least one piece of equipment that shows tube trouble. Such cases interest Revere greatly, because we want condenser tubes to give satisfactory, economical service.

Sometimes the causes of premature failure are obscure and difficult to discover. One of them is stray electricity. When you remember that copper plating is usually done at about 4 to 6 volts, you can see that it doesn't take much to move metal from one place to another through a fluid. Any flow of current through a condenser is sure to be destructive.

Electricity often finds strange routes to ground through high-resistance shorts that do not show up through blown fuses, overheated parts, arcing, and similar obvious indications. Pump motors, for example, may work perfectly well, but permit a little "corrosive" electricity to pass along to ground through the condenser; electrolysis results. Galvanic action, due to the use of metals of too-great dissimilarity, may also occur, but is rare in a condenser properly designed for its operating conditions.

So Revere suggests you include electricity as a possibility when seeking the causes of unexpected tube failure. And it is also advisable to save samples cut from failed tubes, to be sent to Revere for laboratory examination. Facts thus scientifically uncovered may lead to recommendations that will solve the problem. If you have a condenser tube problem, ask Revere to help.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.

• • •

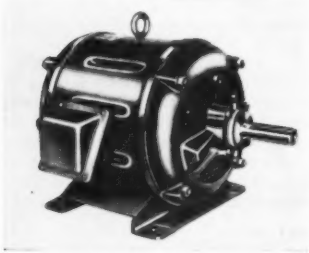
Sales Offices in Principal Cities, Distributors Everywhere

of drum and flexible metal hose is attached to steam supply or to condensate drain line. Rotating assembly inside housing rides on ball bearings inside a seal ring backed by monel bellows against axial leakage. A ring clamp locks bellows to shaft, sealed by silver brazing. Graphite seal is provided for pressure-tight sealing of all industrial fluids.

Special grease fittings prevent overgreasing the bearings. Extended seal face permits seal-face pressure to increase or diminish automatically in proportion to pressure of fluid in application. There are no internal springs and no adjustments are necessary. It is manufactured in eight pipe sizes from ½ to 3 in. and furnished with flexible bronze hose for steam and high-pressure applications, or with rubber hose for water or coolants. **Perfecting Service Co, 6140 Cottage Grove Ave, Chicago 37, Ill.**

Demineralizer E77

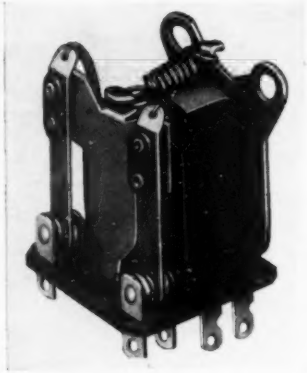
REDESIGNED FILT-R-STIL cartridge demineralizer delivers low-cost chemical equivalent of distilled water without heat at a maximum rate of 10 gal per hr. Unit consists of a disposable cartridge of ion-exchange resin, a bracket or support for the cartridge, and an electrical conductivity indicator that shows quality of treated water and indicates when cartridge is exhausted. Unit requires only 2 watts of electricity. Water delivered by the cartridge unit is guaranteed to contain no more than 10 parts of dissolved ionized solids per million parts of water, exclusive of silica. Rated capacity of the cartridge is 1100 grains (as $CaCO_3$). It can be operated either continuously or intermittently. **Ion Exchange Products Dept, American Cyanamid Co, 30 Rockefeller Plaza, New York 20, N. Y.**



Drip-Proof Motor E92

FRAME DESIGN for polyphase motors in 254, 284, 324 and 326 frame sizes has been adopted from the previous line of smaller-size drip-proof motors. Circulation is provided by auxiliary fan, larger in diameter than motor armature. Air is drawn through front end-plate opening and forced through inner passages and out drive end.

End-plate opening screen gives protection by preventing rags, paper or similar articles being drawn into motor. Sleeve- and ball-bearing motors are completely drip-proof when mounted in normal horizontal position. **Wagner Electric Corp, 6400 Plymouth Ave, St. Louis 14, Mo.**



Miniature Relay E83

SUITABLE FOR AUTOMATIC and remote-control circuit applications, the *Bulletin* 105 miniature magnetic relay is designed for installation where space is limited. Measuring 1⅞ in. high, 1⅝ in. long, and 1 in. wide, the relay has a metal base and solder-type terminals. Device operates on 115-v ac, 60-cycle or 32-v dc circuits; units have double-pole double-throw silver contacts, rated at 3 amp, 115 v. **Ward-Leonard Electric Co, Mt. Vernon, N. Y.**

Belt Dressing E64

LUBRICATES interwoven fibers of leather belts but this belt dressing can also be used on rubber or canvas belts. A neat's-foot-oil base compounded with other ingredients promotes quick penetration to improve gripping surface and lengthen belt life. Available in 1-qt, 1- and 5-gal cans and 50-gal drums. **Alexander Brothers, 406 N Third St, Philadelphia 23, Pa.**

Selenium Rectifier E91

COVERING THE RANGE from 2 v and 150 ma to 5000 v and 10,000 amp, this line of selenium rectifiers has individual plates ranging from 1¼x1¼ in. to 6¼x7¼ in.

Individual selenium plates, capable of withstanding 24-v rms maximum in reverse direction, may be overloaded to ten times rated loads for periods up to 7 sec. Current leakage is less than 1 ma/cm². **International Rectifier Corp, 6809 S Victoria Ave, Los Angeles 43, Calif.**

Oil and Gas Burner E59

CONVERSION UNIT supplies high-temperature air, 700 F, to the point in a gas burner where gas and air ordinarily mix. At this same point atomized oil is introduced and resulting mix burns, says the maker, in any style gas burner. Unit will vaporize No. 1, 2 or 3 oil without forming carbon or condensate. *Oiltogas* converter consists of one air heater assembly and as many insert assemblies as desired. It comes in 1, 2, 4, 6 and 8 million Btu per hr capacities. **North American Mfg Co, 4455 East 71st St, Cleveland 5, Ohio.**

Resistance Bulb E62

THERMOMETER BULB, suitable for operating at temperatures below 600 F, can be installed to replace any thermocouple or filled-system bulb, in a well of ¼-in. or more in diameter, of any depth or material. Heat transfer to sensitive portion of bulb is through its tip instead of side walls. Bulb is easily brought into contact with the well by pushing it against the well bottom, which contributes to rapid temperature measurement. Used with Dynalog electronic instruments, whether recorder, controller or multi-recorder. **Foxboro Co, Foxboro, Mass.**

Baby Speed Reducer E60

A RIGHT-ANGLE single-reduction drive has worm shaft below worm gear. Over-all dimensions are: 4¾ in. long, 3 in. wide and 6¼ in. high. Available ratios range from 6-1 to 58-1 for input horsepowers from ¼ to ⅝, and output torques (at 1800-rpm input) range from 103 to 168 in.-lb. Housing is aluminum alloy. Worm is made of high-grade carbonized steel and worm gear of nickel bronze. **Ohio Gear Co, 1400 E 179th St, Cleveland 10, Ohio.**

Smoke Meter E52

PERMANENT-RECORDING gas-sampling meter consists of a sampling unit and an electrically driven vacuum pump. It operates automatically. A paper test disk is inserted

(*Continued on page* 148)

Use convenient reply cards on page 196a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

Cost Cutter for Users of

HOT PROCESS LIME-SODA SOFTENERS

Nalco $Na_2Al_2O_4$

SODIUM ALUMINATE

NALCO Sodium Aluminate—one of the many Nalco chemicals for effective water treatment—has special interest to users of hot process lime-soda softeners because of its efficiency and cost-cutting possibilities in most applications. Nalco Sodium Aluminate not only reduces hardness of softener effluent, but frequently cuts the need for phosphate after-treatment to such an extent that the savings on phosphate alone *more than pay for the $Na_2Al_2O_4$ used!*

Typical hardness and alkalinity analyses given at right serve to show what you may expect from properly applied Nalco Sodium Aluminate treatment. For details on the Complete Nalco System of Water Treatment for your plant, call your Nalco Representative—or write Nalco today.

Nalco chemicals are available in liquid, granular or powder forms, and in convenient 1-lb. ball briquets.

TYPICAL ANALYSIS WITHOUT Nalco SODIUM ALUMINATE

Total Hardness	Phenolphthalein Alkalinity	Methyl Orange Alkalinity
1.3 gpg.	2.5 gpg.	4.2 gpg.

TYPICAL ANALYSIS WITH Nalco SODIUM ALUMINATE

Total Hardness	Phenolphthalein Alkalinity	Methyl Orange Alkalinity
0.5 gpg.	2.0 gpg.	3.5 gpg.

NATIONAL ALUMINATE CORPORATION

6222 W. 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem, Limited Burlington, Ontario

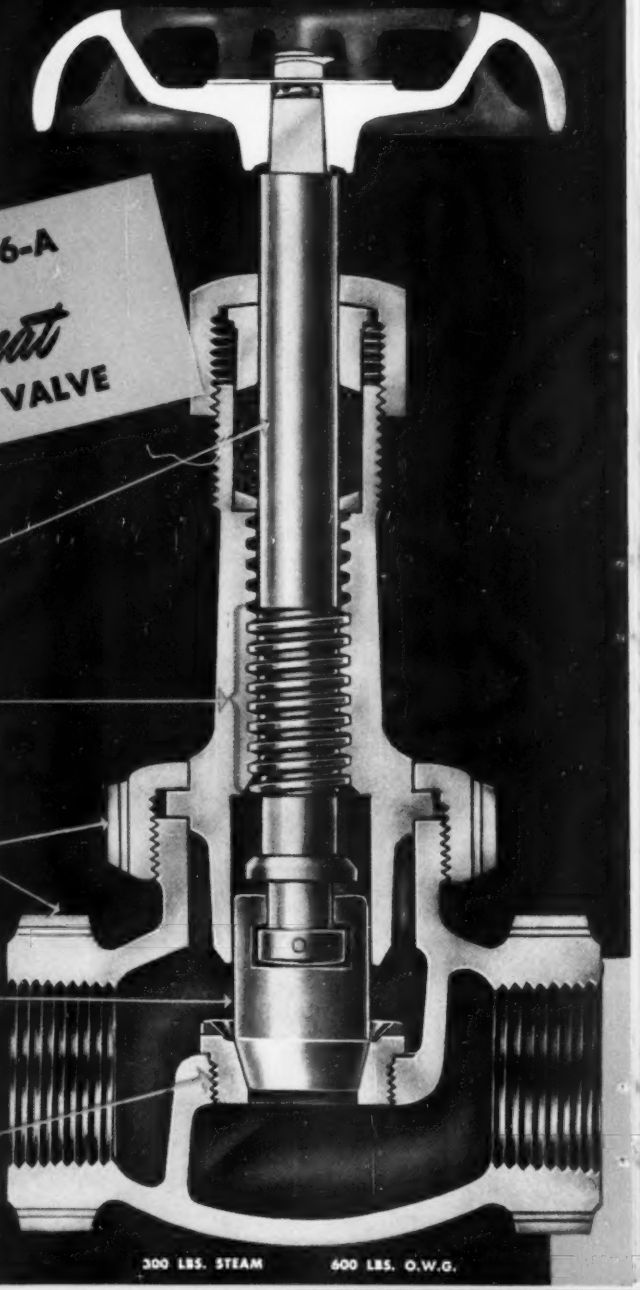
A Nalco PRODUCT

• • • Serving Industry through Practical Applied Science

IT'S NEW! . . .

IT'S JENKINS ANSWER

JENKINS FIG. 976-A PLUG TYPE *Armor Seat* BRONZE GLOBE VALVE



NEW "TUFFARD" SPINDLE Aluminum bronze of tensile strength exceeding 65,000 lbs.—tough to take stresses, *hard* for long wear. Bigger in diameter—more strong threads.

MORE THREADS, LESS WEAR Additional threads in bonnet and on spindle assures full thread engagement—*open or closed*—less load, less wear per thread.

NEW STURDY LUGS Flat-faced, V-shaped lugs on union bonnet ring and body ends permit firm fit and grip of open end, pipe, or monkey wrench, withstand repeated disassembly.

NEW SLIP-ON, STAY-ON PLUG Simple design with T-slot for engaging spindle head is stronger, trouble-free, permits free flow. Mirror-finished bevel assures perfect mating with seat ring.

500 BRINELL ARMOR SEAT DEFEATS TOUGHEST VALVE ENEMIES Plug and Seat Ring of Jenkins JX500 special alloy stainless steel—heat treated to 500 Brinell hardness and extraordinary ductility—lapped together to a mirror finish. Unaffected by throttled steam, resists galling, abrasion, erosion, and corrosion.

300 LBS. STEAM 600 LBS. O.W.G.

IT'S A DOZEN WAYS BETTER!

TO VALVE-KILLING SERVICES!

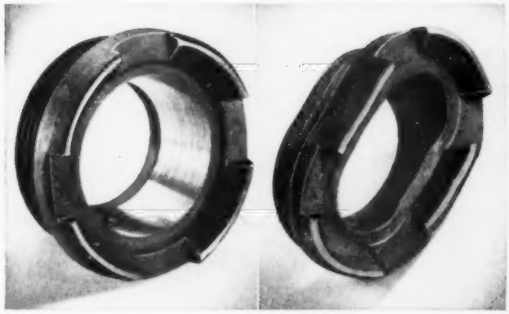
BUILT TO BREAK RECORDS FOR LONG LIFE

Now, for the worst valve-killing services, you can specify the new Jenkins Fig. 976-A with complete confidence that it will set new economy records. Compare it, part for part, and you'll agree it's as nearly wear-proof, trouble-proof, and maintenance-free as any stock valve can be.

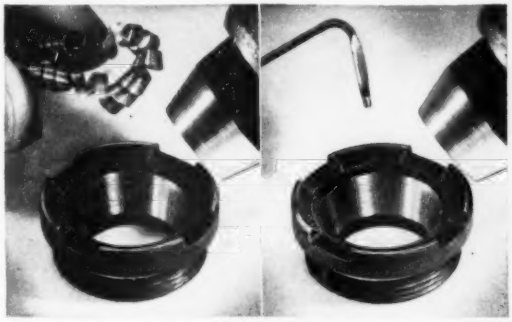
Use the new Fig. 976-A to safeguard your production against shutdowns due to valve failure. Use it in the most severe services you have,—pressure regulation, steam control by-pass lines, temperature regulation, bleeds, drips, and drains, soot blowers, or any close regulation of steam. Use it where throttled steam threatens wire drawing, where entrapped pipe chips, scale, or rust tubercles are a problem.

Check over the new features indicated here—only a few of a dozen ways Jenkins Engineers have made this new valve unrivaled for endurance and economy. Then get the complete story,—in a new folder jam-packed with reasons why the new Fig. 976-A is your best buy in plug-type valves. Send the coupon today.

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.



TAKES 18,340 LB. LOAD WITHOUT CRACKING *Compare the Jenkins JX500 Seat Ring (left) before and (right) after being deflected over 37% by a nine ton load. Not a sign of fracture! That's proof of its super toughness!*



SMASHED PIPE CHIPS, WIRE LEAVE NO SCARS *Chips from a standard steep pipe (left) and 1/16" wire rod having a Brinell hardness in excess of 300 were crushed between the new Jenkins JX500 Plug and Seat Ring without leaving a scratch or dent. That's proof of super hardness!*

LOOK FOR THIS TRADE JENKINS MARK DIAMOND MARK

SINCE Jenkins Bros 1864

JENKINS VALVES

Types, Sizes, Pressures, Metals for Every Need
Sold through Reliable Industrial Distributors everywhere

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Address .....

.....

POWER'S DATA SHEETS

Number 199

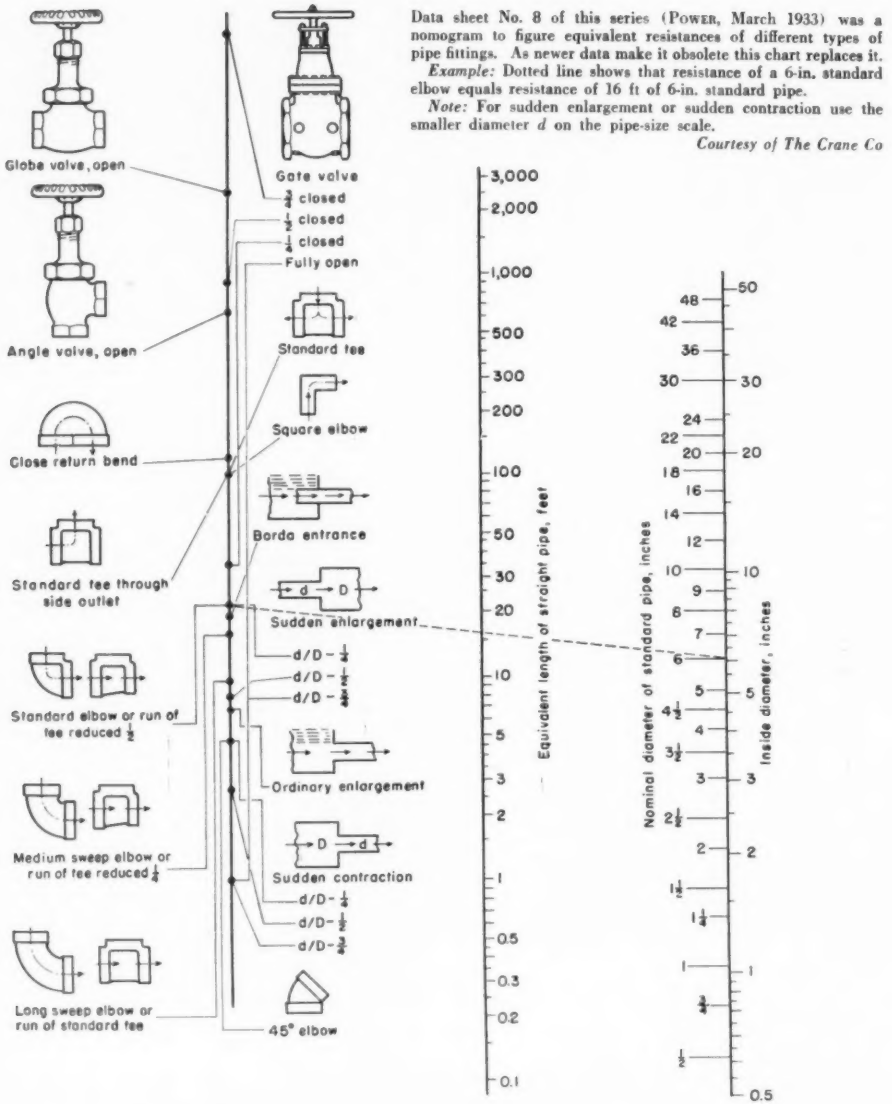
Resistance to Fluid Flow

Data sheet No. 8 of this series (POWER, March 1933) was a nomogram to figure equivalent resistances of different types of pipe fittings. As newer data make it obsolete this chart replaces it.

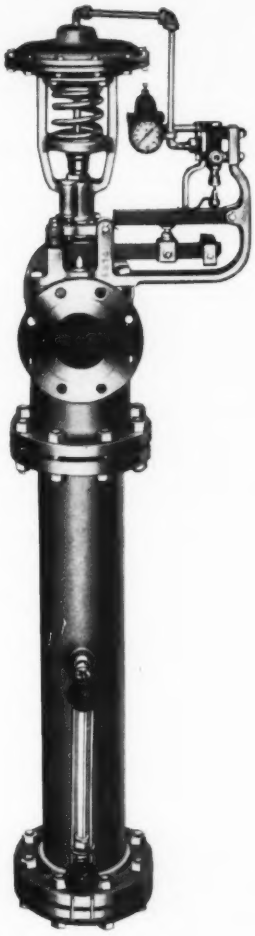
Example: Dotted line shows that resistance of a 6-in. standard elbow equals resistance of 16 ft of 6-in. standard pipe.

Note: For sudden enlargement or sudden contraction use the smaller diameter d on the pipe-size scale.

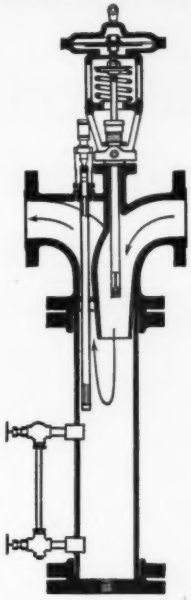
Courtesy of The Crane Co



Self-Contained DESUPERHEATER



Cooling water completely atomized at all rates of flow . . . final steam temperature held closely . . .



Easily installed, the COPES Desuperheater holds the final steam temperature within plus-or-minus 5 degrees F., regardless of changes in initial temperature or rate of flow. Self-contained, it has no outside valve controlling flow. Complete atomization of the cooling water is assured by controlling its flow at the spray nozzle, across which pressure drop is held constant. Intimate contact of water and steam is at point of greatest turbulence in mixing chamber. Write for descriptive Bulletin 405-A.

NORTHERN EQUIPMENT COMPANY
219 GROVE DRIVE, ERIE, PA.
BRANCH PLANTS: Canada, England, France and Austria
Representatives Everywhere

ENGINEERED BY THE MAKERS OF COPES
FLOWMATIC

COPES furnishes pressure-reducing and desuperheating stations designed and built for the individual installation. COPES also builds-to-measure boiler superheat controls responsive to both steam flow and temperature.

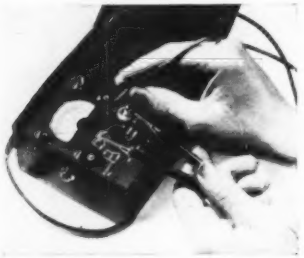
COPES

Headquarters for . . .

Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.

NEW EQUIPMENT CONTINUED

and the control switch turned on to start the unit. Sampling interval can be varied from 30 to 90 seconds, which permits adjustment for samples covering a range of smoke densities. Smoke leaves a deposit on the disk, varying in shading with its density. **Bacharach Industrial Instrument Co, 7000 Bennett St, Pittsburgh 8, Pa.**



Miniature Tester E84

OHMMETER AND VOLTMETER, suitable for testing resistances and both ac and dc voltages, are combined in the *Miniature Multitester*. As an ohmmeter, device will measure resistance from 0 to 2 megohms and dc voltages between 0 and 300 with an accuracy of ± 2%.

Self-contained rotary switch allows operator to select various resistance measuring ranges. All readings are shown on a single, 2-scale dial, designed to simplify reading. Tester is suitable for all-round electrical trouble shooting. **International Instruments, Inc, 311 East St, New Haven 11, Conn.**

Emergency Lighting Unit E86

WHENEVER REGULAR LIGHTING voltage fails, this unit automatically switches on to supply floodlighting over large area. With an 8-ft cord to plug into any 120-v lighting outlet, emergency light is provided by standard 9-v dry battery.

Unit is suitable wherever a constant light source is required. **U-C Lite Mfg Co, 1050 W Hubbard St, Chicago.**

Surfacing Powder E57

HARD-SURFACING POWDER, *Surfaceweld A*, applied with a carbon electrode, deposits a thin chromium carbide surface highly resistant to abrasion and corrosion. It may be used with an ac arc and a single carbon electrode or with dc and a twin carbon arc, with carbon electrode negative. Corrosion resistance is held comparable to stainless steel. Hardness runs about 54-61 Rockwell C for one layer and 57-63 for multiple layers. **Lincoln Electric Co, Cleveland 1, Ohio.**

Boiler Returns E56

REDESIGNED, motor-operated boiler-water return system has its shaft in a vertical position as against the previous horizontal mounting. Manufacturer claims among the advantages a reduction in thrust on the throat bearing, greater dynamic head from three vertical pump stages, motor-mounting removed from exposure to possible wetting. **David Stout & Sons, 7016 Manchester Ave, St. Louis 17, Mo.**

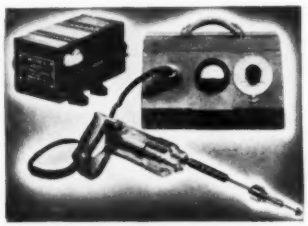
Vertical-Pump Motor E69

DEEPWELL turbine vertical pump motor has interchangeable base to permit increase or decrease in horsepower without remachining or exchanging the pump head. A weatherproof housing protects vital motor parts from injurious weather conditions. Downdraft ventilation prevents reentry of expelled hot air by blasting the air about five diameters away from the motor.

Flush-style gage has Lucite window that shows bearing-oil supply. Adjustable hollow shaft permits precise positioning of deepwell turbine-pump impellers. It also allows placing the heavy thrust bearing in the motor's top and eliminates the necessity of using a flexible coupling to connect motor to pump-shafts. Standard designs include a reverse protection clutch. A special nonreversing locking device can be provided. **U. S. Electrical Motors, 200 East Slauson Ave, Los Angeles 54, Calif.**

Gear Lubricant E61

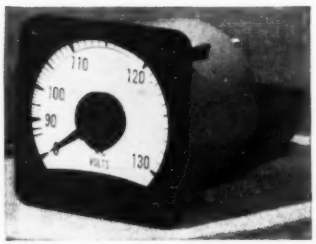
LIQUID GEAR SHIELD lubricates exposed, open and partially enclosed gears, also slides, wire ropes, cables, dipper sticks, as well as the swing-circular rack teeth and dipper-handle racks of excavation and industrial machinery. Being liquid the lubricant can be applied with a brush or poured onto the gears. Heating prior to application is not required and the lubricant promptly sets to an almost dry film. It is highly adhesive and will not throw off the gears even at high speed. Does not solidify or become brittle at temperatures below zero. **Pennsylvania Refining Co, 2686 Lisbon Rd, Cleveland 4, Ohio.**



Condenser Tube Expander E96

ELECTRICALLY CONTROLLED tube expander is capable of precision tube expanding, even in the hands of inexperienced workers. Device eliminates over-expanding of tubes, cuts erosion possibilities and extends tube life.

Device automatically turns off expanding motor at predetermined value for each size and gage tube. Motor operates on 115-v ac through control unit. Complete device weighs about seven pounds. **Crane Packing Co, 1800 W. Cuyler Ave, Chicago 13, Ill.**



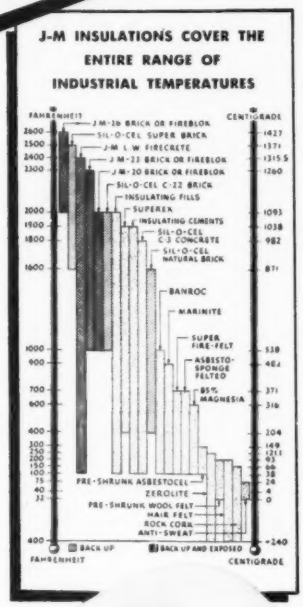
Large-Scale Voltmeter E90

DESIGNED for general switchboard service, this meter has a scale 7.1 in. long and spanning 250 deg about center. Scale is expanded between range of 90 to 130 v, enabling measurement of 0.5-v variation. Meter's accuracy is plus-minus ½% in range of 105 to 125 v. Though available

(*Continued on page* 178)

Use convenient reply cards on page 196a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, E, and number, as shown on the items above.

Facts about J-M Insulations Subject: MATERIALS



The RIGHT Insulation helps industry offset higher fuel costs

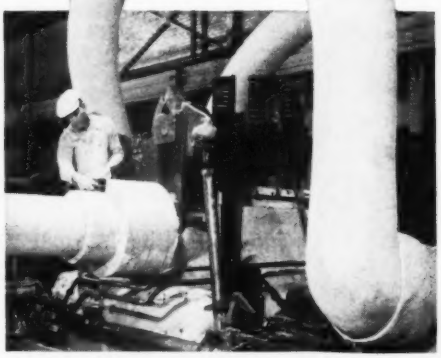
TODAY'S higher fuel costs emphasize the importance of insulation more than ever before.

Average price at the mine for bituminous coal in 1931 was $1.54 per ton. In 1946, the most recent figure published, industry paid $3.44 per ton, and today the average price is estimated at more that $4.

Industry must choose the RIGHT Insulation to offset these higher costs. Any insulation will save *some* money. Only the *right* insulation, specifically engineered for a specific job, will save the most money for the longest period of time.

Special Insulating Problems solved with Special Materials

No single raw material will produce an insulation that operates efficiently under all industrial service conditions. That is why Johns-Manville manufactures many insulations from many selected raw materials. Johns-Manville is constantly developing and testing new insulations . . . to meet special industrial problems and to anticipate future needs of industry.



Skilled mechanics applying canvas jacket over J-M 85% Magnesia.

J-M insulations, made from asbestos and other raw materials, span the entire range of temperatures from 400°F. below zero to 2600°F. above. On the job, they provide that right combination of physical and thermal properties so essential for proper application and maximum fuel savings.

Forming a link between you and Johns-Manville Insulation Research is a network of contracting firms specializing in the practical use of J-M Insulations. First, their insulation engineers choose the type and thickness of materials best suited to your needs. Next, skilled mechanics in their employ assure efficient, economical application.

For complete details and answers to your special insulation problems, write Johns-Manville, Box 290, N. Y. 16, N. Y.

Johns-Manville

First in INSULATIONS

TECHNICAL BRIEFS

ENGINEERING DEVELOPMENTS HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

REVIEWED IN THIS ISSUE

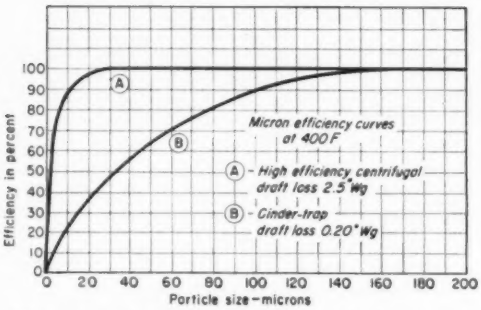
FUELS AND FIRING
Work of U. S. Geological Survey
Combustion Ash Collection

GAS TURBINES
Investigation of Gas-Turbine Components
Design Practices for Gas Turbines

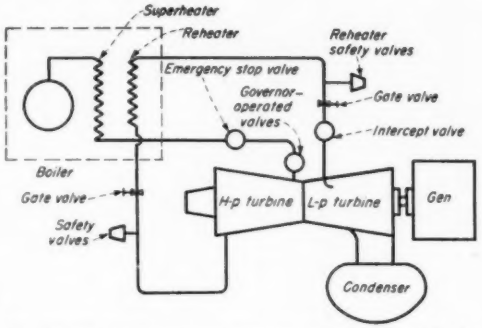
STEAM TURBINES
Steam Turbines for Resuperheat Cycle
Performance Characteristics of Extraction-Turbine Governors

WATER TREATMENT
Organic Cation Exchangers for Municipal Water Softening
Pulp and Paper Mill Wastes
Circulating-Water Treatment Practice

Directions for ordering papers are given on page 152


Efficiency in percent
Particle size—microns
Micron efficiency curves at 400°F
A - High efficiency centrifugal draft loss 2.5" Wg
B - Cinder-trap draft loss 0.20" Wg

1 Comparison of efficiency of centrifugal dust collector and cinder trap shows how loading of gas leaving units differs



2 Turbine for resuperheat requires an intercept valve plus usual controls so unit doesn't run away with loss of load

FUELS AND FIRING

WORK OF THE U. S. GEOLOGICAL SURVEY ON COAL AND COAL RESERVES, *by Paul Averitt, U. S. Geological Survey.* Field work is now in progress in 13 sections of the country, mapping out the coal field and detailing where possible information on thickness, distribution and quality of coal, and the structure and stratigraphy of coal-bearing rocks. Two of these 13 areas, the Paonia field in Colorado and the Coosa field in Alabama, are the subjects of two recently released preliminary reports.

Last revised figures on coal reserves in the country are those of 1928 based on the original Campbell listings. These reserves are due for a substantial revision. But any reserve statement is of little value unless data like the following are available on how limits of coal are established at depth, minimum thickness of coal considered, weight of coal assumed.

In these recent surveys, now under way, the author states that the standard nomenclature of Geological-Survey Bureau of Mines was accepted. This permitted defining coal reserves by three classes, according to reliability of data available for calculations.

Measured coal: Tonnage is computed from dimensions revealed in outcrops, trenches, mine workings and drill holes. Points of observations and measurement are so closely spaced and coal thickness so well defined that computed tonnage is judged accurate within 20%.

Indicated coal: Tonnage is computed partly from specific measurements and partly from projection of visible data for a reasonable distance on geologic evidence.

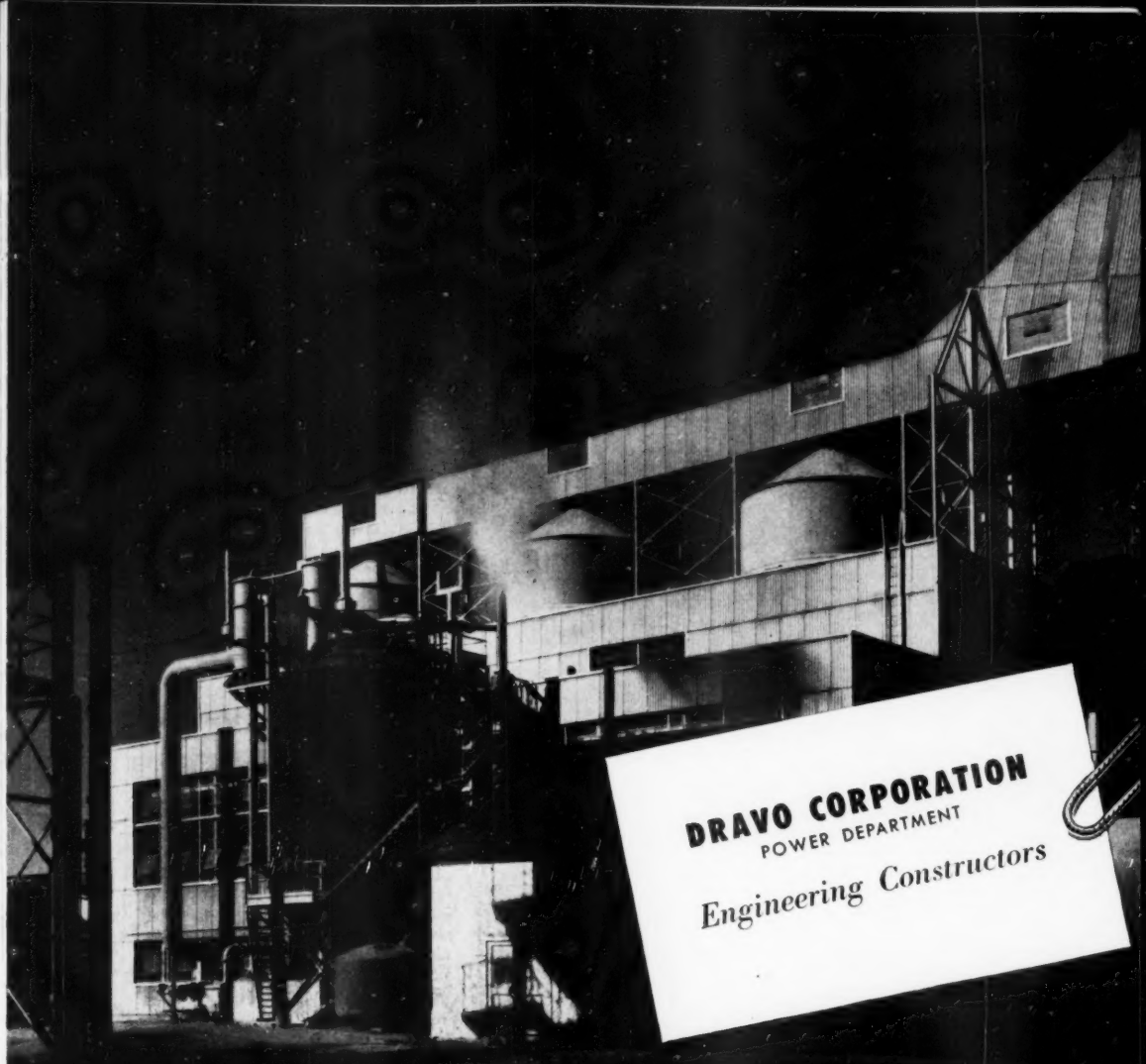
Inferred coal: Quantitative estimates are based largely on a broad knowledge of the geologic character of the bed, or region, for which there are few measurements, if any. In general, this class of coal lies outside the limits defined for measured and indicated coals.

These terms compare closely with *proved, probable* and *possible* — the terms in general use in the coal industry. *AIME Paper.*

COMBUSTION ASH COLLECTION FOR THE SMALL POWER PLANT, *by Philip F Best, Thermix Corp.* Here is an attempt on the part of the author to combat the average small-plant owner's lack of interest in efficient dust collection. Whenever the small plant uses collectors it usually restricts collection to a cinder trap or some low-cost low-efficiency system. The reasons for this choice are: (1) Smaller plant usually uses stoker firing. And ash from this method of firing runs much coarser and, if efficiently fired, much less than that produced by pulverized-coal firing. Therefore, an ash-collecting device that handles the larger particles seems good enough. (2) Local dust codes generally concentrate on larger plants. (3) Power-plant costs are held as low as possible. Collector equipment with the added expense of an induced-draft fan makes average designer avoid it.

But what about the jobs performed by a centrifugal dust collector compared with a cinder trap? Pulverized-fuel ash, after passing through a centrifugal collector such as tested, no longer has any particles above 30 microns in size.

The author ties this fact down to dust-loading for the different firing methods, which he says amounts to 2.6 lb of dust per 1000 lb of gas for stokers and 4.4 per 1000 lb for pulverized coal. The centrifugal collector efficiency of 91.2%, Fig. 1, reduces loading of outlet gas for the pulverized coal to about 0.39 lb per 1000 lb of gas, and the outlet loading of gas from the 80% efficient cinder trap runs 0.52 lb per 1000 lb. *ASME Paper No. 48-A-55.*



The PEOPLES NATURAL GAS COMPANY'S recently modernized compressor station at Brave, Pa. Building construction and equipment installation were performed by the Power Department of Dravo Corporation on a single contract basis.

DRAVO
CORPORATION

DRAVO BUILDING · PITTSBURGH 22, PA.

Engineering Constructors of power plants, boiler plants, central stations, compressor stations, water pumping stations—fabricators and erectors of power piping—power and boiler plant equipment.

Pittsburgh, Philadelphia, Cleveland, New York, Detroi

GAS TURBINES

CURRENT DESIGN PRACTICES FOR GAS TURBINE POWER ELEMENTS, *by H D Emmert, Allis-Chalmers Manufacturing Co.* Design practices for gas turbines are in continuous development. Each new machine contributes to an increasing store of knowledge, permitting subsequent designs to be improved in many respects. For commercial gas turbines, innovations must be adopted cautiously and gradually because of the large financial risk to both buyer and builder.

The paper is almost completely confined to design of the blading and disks of the turbine element for stationary and large-power transportation applications. Interesting comparisons are made at some points between this type of unit and the aviation gas turbine. Useful service life and mechanical reliability of a gas-turbine plant are governed almost entirely by the design of the power element. This design must be a compromise between requirements of high efficiency, dependability and ease of manufacture. *ASME Paper No. 48- A-69.*

MECHANICAL INVESTIGATIONS OF GAS TURBINE COMPONENTS, *by Carl Shabtach, General Electric Co.* Despite the close resemblance of steam and gas turbines, designers feel it wise to test critical components of gas-turbine plants. The paper describes the testing procedure used in designing the locomotive gas-turbine unit built by his company. See POWER, August 1947, pp 68-70, and May 1948, pp 95, 98.

Procedures and results are given for finding bursting strength of turbine and compressor wheels, fatigue strength of compressor blades, deflection and stress in nozzle diaphragms, resistance to fluctuating thermal stresses, tensile strength of dovetail attachments, rotor critical speed and other design criteria. *ASME Paper No. 48-A-47.*

STEAM TURBINES

STEAM TURBINES FOR RESUPERHEAT CYCLE, *by E E Parker, General Electric Co.* Back in the middle nineteen-twenties and early thirties a number of installations were put in power stations for use with the resuperheat cycle. Initial temperatures had reached 750 F and a thermal gain of 5 to 6% could be obtained in thermal efficiency from this cycle. This gain was not equaled by nonreheat cycles until initial temperatures had been pushed up to the range of 900 F.

Today the 900 and 950 F initial temperature condition stands in common use. Temperatures of 1150-1200 F, whose use will probably be general, still await the future developments in metal progress. So today the resuperheat cycle again promises a thermal heat gain from present initial temperatures that closely parallels the experiences of 20 years ago.

A turbine for the resuperheat cycle requires customary controls plus an intercept valve, Fig. 2. This valve is located close to the turbine in the line returning steam from the reheater. This intercept valve performs the sole function of preventing turbine speed from reaching 110% and tripping the emergency governor when a sudden loss of all, or all but a small portion, of the electrical load occurs. If it were not for this valve, upon loss of electrical load, the unit would speed up and trip the emergency stop valve even if the main steam-supply valves were closed. *ASME Paper No. 48-A-58.*

PERFORMANCE CHARACTERISTICS OF SPEED GOVERNORS ON AUTOMATIC EXTRACTION TURBINES DRIVING ELECTRIC GENERATORS, *by L B Wales, General Electric Co.* Usually the regulation or percent change in speed from no load to full load for a governor-controlled condensing-steam turbine is about 3 to 4%. But if a separate pressure-controlled governor supervises the steam outlets of automatic extraction turbines, the total over-all regulation may increase to as much as 9% under some circumstances. This unsatisfactory regulation is overcome by providing compensated control systems in which both the speed governor and pressure governor operate both governing and extraction-control valves. Thus an increase in load opens both governing and extraction valves with an acceptable drop in speed, simultaneously maintaining constant extraction flow. A change in extraction flow with no change in power demand on the turbine will, for example, close the extraction-control valve (reducing steam to exhaust), and simultaneously open the inlet governing valves without change in power output or speed. In other words, the over-all regulation of the unit at all extraction flows can be maintained within the desired 3 to 4%.

Several methods are available to realize these compensated systems. Special attention must be devoted to design of overspeed governors on automatic-extraction turbines because overspeed is greater than on straight condensing turbines with the same regulation. *AIEE Paper No. 48-282.*

To Obtain Complete Text

Material for these abstracts came from one of the following sources:

American Society of Mechanical Engineers, annual meeting, New York, Nov 29-Dec 3, 1948. Papers are identified by initials ASME and paper No. Available at ASME, 29 W 39th St, New York 18.

American Institute of Mining Engineers, joint meeting, fuels div, ASME, coal div, AIME, White Sulphur Springs, W.Va., Nov 2, 3, 1948. Papers are identified by initials AIME. Available at AIME, 29 W 39th St, New York 18.

Engineering Society of Western Pennsylvania, ninth annual water conference, Pittsburgh, Pa., Oct 18-20, 1948. Papers are identified by initials ESWP. Available in proceedings, $7.50 through ESWP, Hotel Wm Penn, Pittsburgh.

American Institute of Electrical Engineers, Midwest general meeting, Milwaukee, Wis., Oct 18-22, 1948. Papers are identified by initials AIEE and paper No. Available at 29 W 39th St, New York 18.

WATER TREATMENT

PROGRESS IN THE TREATMENT OF PULP AND PAPER MILL WASTES, *by W W Hodge, Mellon Institute of Industrial Research.* Problem of paper-mill wastes is first broken into two divisions, solid and liquid. For solid wastes a number of developments along the lines of reclaiming valuable byproducts have been introduced. They include commercial chemicals from wood distillates, tannins from the bark of Douglas fir, a wood molasses from normally waste woods for growing and fattening pigs, increased resin, turpentine and naval stores from waste wood of cutover pine lands and around lumber and pulp mills, kraft pulp from waste wood.

In the liquid-waste field a number of research and reclamation programs are now on. Improved screens and save-alls have increased the percentage recovery of small fibers formerly lost in liquid waste. Nearly closed recirculation systems have cut down on the over-all volume of liquid discharged as waste. Spent sulphite liquors produce alcohol in at least one U. S. and one Canadian plant, as well as in several in Europe. Other chemicals besides vanillin and vanillic acid are being produced from the Howard-Marathon process; more tannin is being recovered; some residual solids serve as fuel; one plant in Wisconsin is under construction for making fodder yeast.

But still, after 50 years of research, utilization and disposal of waste sul-

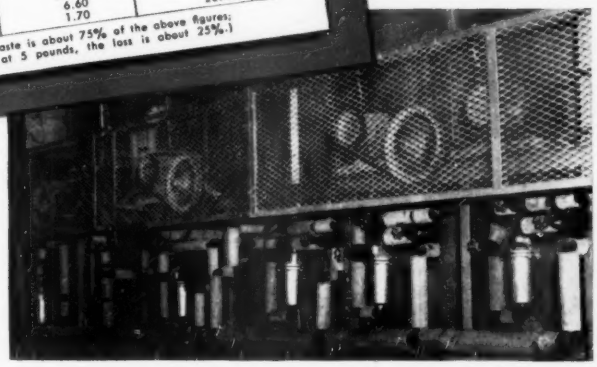
(*Continued on page* 162)

SMALL STEAM LEAKS *add up!*

Showing cost of various sized steam leaks at 100 pound pressure. (Assuming steam costs 50 cents per 1000 lbs.)

Size of Orifice	Lb. Steam Wasted Per Month	Total Cost Per Month	Total Cost Per Year
1/2"	835,000	$417.50	$5,010.00
3/8"	470,000	235.00	2,820.00
1/4"	210,000	105.00	1,260.00
1/8"	52,500	26.25	315.00
1/16"	13,200	6.60	79.20
1/32"	3,400	1.70	20.40

(For steam at 50 pounds pressure, the waste is about 75% of the above figures; at 20 pounds, it is about 50%; and at 5 pounds, the loss is about 25%.)

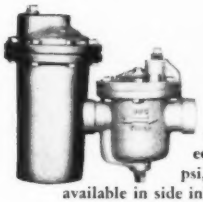


TYPICAL FUEL SAVINGS SECURED WITH ARMSTRONG TRAPS

20% FUEL SAVINGS after trapping all heating coils individually. — Norton Greenhouses, St. Paul, Minn.

33-1/3% REDUCTION IN ANNUAL COAL BILL after installing Armstrong traps on cooking vats. — Ralph L. Smith Lumber Co., North Kansas City, Mo.

3,728 GALLONS OF FUEL OIL SAVED in one year after replacing old traps with Armstrongs on kettles, low pressure heating system and cream beaters. — Mary Lincoln Candies, Buffalo, N. Y.



STEAM SAVERS:

For trapping heating systems and process equipment from 1 to 250 psi, Armstrong Traps are available in side inlet—side outlet or bottom inlet—top outlet body styles. These compact, dependable traps provide more actual hot condensate capacity per dollar of trap investment than any other traps on the market. For selection data, capacities and prices SEND FOR the 36-page ARMSTRONG STEAM TRAP BOOK.

CHECK YOUR STEAM TRAPS *now!*

The chart above shows that a "little" steam leak can cost a lot—and a hundred or a thousand little leaks cost a lot more! No plant can afford the luxury of leaky steam traps. It costs far more to keep them than it does to replace them with modern Armstrong Inverted Bucket Steam Traps. Armstrong Traps won't leak steam because:

1. The valve and seat are ground and lapped to a precision, steam-tight fit.
2. The valve is water-sealed at all times.
3. Both the valve and seat are made of chrome steel, heat treated for long life and corrosion and erosion resistance.

With today's high fuel and operating costs Armstrong traps are priced lower in proportion to the savings they can effect than at any time in their history. Let your nearby Armstrong Representative help you select the traps you need or write direct to the factory.

ARMSTRONG MACHINE WORKS
812 MAPLE ST., THREE RIVERS, MICH.

ARMSTRONG *Inverted Bucket* STEAM TRAPS

Factory Representatives in 48 Key Cities... Traps Stocked at 147 Points

How Long Can a Man Sprint?

Depends, of course, on who's doing the running. In any case, all of us will agree that even the strongest sprinter can't keep on doing the 100-yard dash for more than a few seconds. In economics and business, though, some people expect our economy to keep on at a 100-yard-dash pace indefinitely.

One of my friends in the utility field—who keeps track of figures and statistics on how many kwhr are turned out, etc—had a face on him the other day longer than a Mississippi mule's. When I asked what his trouble was, he claimed business was terrible, the slump was here, and the country was going to you-know-where.

"How do you figure that?" I asked him.

"Oh, kwhr sales for the country are down, and you must know that this figure is about the best indication you can get on what's going to happen to the rest of the country."

When I pinned him down as to how much this index had declined, it turned out that kwhr sales for the month were ONLY 8% above the same period last year, as compared with an increase of about 20% that had been rung up steadily since 1946.

Many of us have become so accustomed to spectacular gains in production, in employment, in business operations of all kinds, that increases month after month have become normal. Now, it appears we're beginning to go into a period of leveling off—and the prophets of doom are starting to take up the chant of trouble abrewing.

To sell America short by forecasting recessions and depressions has no basis in logic, with the tremendous potential this country has to produce and to consume. And we in the power business—who have seen the application of ever increasing amounts of energy help make more goods and services and jobs for more people—should have more faith in the future than anybody.

For example, when the utilities get their 78,000,000-kw installed capacity turning over in 1953, they will be the coal mines' biggest customer. But more impressive is this: With technological improvements in mining, which have increased the tons of coal produced per miner, and with progress in power engineering, which gets us more energy out of every pound of coal, there will still be more coal used by the utilities than ever before. And this, in turn, should result in more workers gainfully employed in the mines. Then, if the gas turbine locomotive can be designed to burn coal successfully (which looks likely), the coal industry will have another new market.

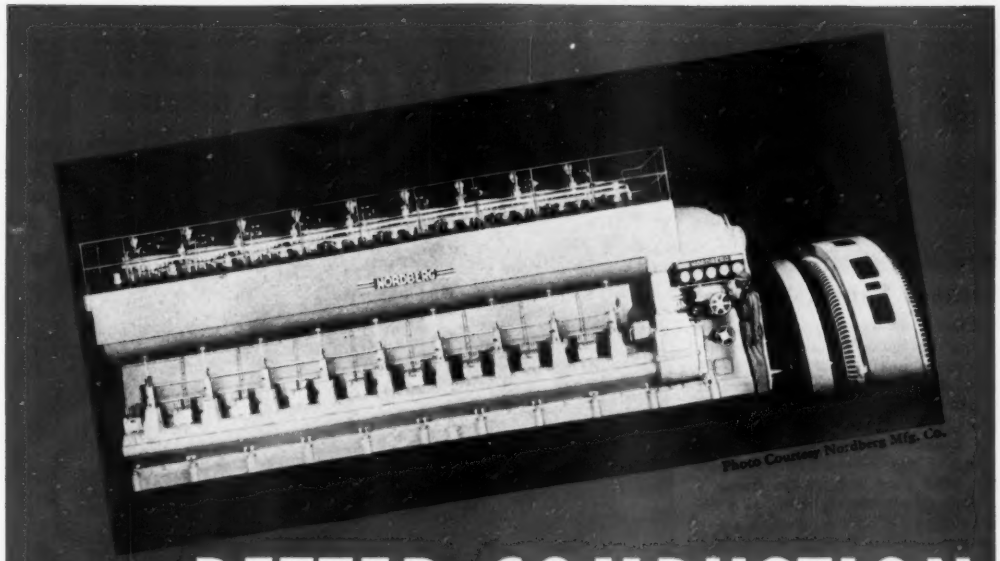
All any of us has to do to obtain renewed faith is take a look at all the many, many ways we can improve operations. There's still a lot of slack in *distribution*, which can be taken up to permit getting goods from manufacturer to buyer at less cost. We've just scratched the surface on such things as *inventory control, materials handling, sales administration, production control, accounting*, and so on—all of which can be made more efficient and the savings applied to lower the cost of products.

With lower costs, the consumer can buy more and still satisfy his appetite for new things as they come along. Net result is more jobs for more people, and a continuously progressing economy.

So we've come to a leveling-off period, and kwhr sales may be *only* 8% above last year. But have you noticed that waiters are beginning to speak respectfully, that clerks in the department stores give service, that the plumber comes when you call? Is that bad? Or cause for alarm?

George Edwards

Engineer



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POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

New Retort for Oil Shale Exceeds Expectations

► ONE OF THE MAJOR PROBLEMS in converting the nation's immense oil-shale reserves to useful liquid fuels is a step nearer solution with the announcement by James Boyd, director of Bureau of Mines, that the initial test run in a new continuous-type retort at Rifle, Colorado, has exceeded expectations. This pilot plant unit at the Bureau's oil-shale demonstration plant has a design capacity of 25 tons of shale a day and has operated quite smoothly from the outset. Minor mechanical difficulties are being corrected.

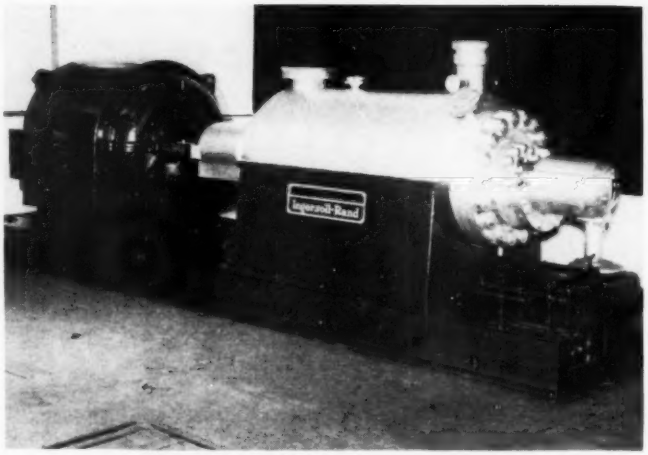
Oil recoveries have exceeded the Fischer assay value of the 30 gal per ton shale used, Boyd said. When spent shale processed in this initial test was also assayed it yielded no additional oil, indicating that extraction in the retort was complete. Detailed performance data will not be available, however, until further tests are made.

Gas-Flow Retort. The new unit is known as the gas-flow retort because incoming raw shale is heated by a transverse flow of gas derived from the process. In this process, shale crushed to small size passes continuously downward between two sets of louvers. Hot gases are driven across downward-moving bed to retort the shale, and spent shale is withdrawn continuously from bottom of the unit.

If exhaustive tests prove that the pilot plant is efficient, the process will offer good prospects for larger developments. Indicated advantages are that large tonnages of shale can be handled at a modest construction outlay and considerable quantities of high calorific gases could be produced for other plant use. The process will be thermally self-sustaining, for, in addition to waste gas, spent shale will be used for heating the required hot gases.

Batch-type retorts of the N-T-U variety have been in operation at Rifle for more than a year, the director stated. They were installed to obtain operating experience and data and to produce shale oil, pending development of a continuous type of retort suited to Colorado oil shale. Another batch-type unit known as the Royster-process retort

(*Continued on page* 196)



Feed Pump Operates at 2500 Psi

Shown above is one of three 1100-gpm 11-stage 2400- to 2500-psi centrifugal feedwater pumps for use with the boiler that will supply 137,500 kw to Philip Sporn Unit No. 1, planned for service during July 1949. The power plant, which has four such turbine-generators authorized, is jointly owned by Appalachian Electric Co and Ohio Power Co, and was designed by American Gas and Electric Service Corp. Three of these Ingersoll-Rand pumps supply water to the boiler, which operates at 2170 psi and can supply 950,000 lb of steam per hr at 1050 F. Each of these pumps is driven by a 2000-hp 2300-v 3570-rpm constant-speed squirrel-cage Allis-Chalmers induction motor that is designed for across-the-line starting

COMING EVENTS

Jan 31-Feb 4—American Institute of Electrical Engineers, winter general meeting, Pennsylvania Hotel, New York, N. Y. H H Henline, secretary, 33 W 39th St, New York 18, N. Y.

Feb 4-6—Refrigeration Equipment Manufacturers Assn, first Southern refrigeration and air-conditioning educational conference and exhibit, Birmingham City Auditorium, Birmingham, Ala. H F Hildreth, president REMA, 1346 Connecticut Ave, N. W., Washington 6, D. C.

Feb 10-11—Prime Movers Committee, Pennsylvania Electric Assn, midwinter meeting, Hotel Hershey, Hershey, Pa. John W Mikels, chairman, c/o Pennsylvania Power Co, 19 E Washington St, New Castle, Pa.

Mar 2-6—Electric Assn of Kansas City, electrical exposition, Municipal Auditorium, Kansas City, Mo. Frank F Robinson, publicity director, Exposition of Electrical Progress Assn, 106 W 14th St, Kansas City 6, Mo.

Apr 11-13—American Society of Lubrication Engineers, meeting, Hotel Pennsylvania, New York, N. Y. W F Leonard, secretary-treasurer, 343 S Dearborn St, Chicago 4, Ill.

Apr 11-14—National Assn of Corrosion Engineers, meeting. Netherland Plaza Hotel, Cincinnati, Ohio. A B Campbell, executive secretary, 905 Southern Standard Bldg, Houston 2, Texas.

Apr 18-20—Midwest Power Conference, Sherman Hotel, Chicago, Ill. Roland A Budenholzer, conference director, c/o Illinois Institute of Technology, 3300 S Federal St, Chicago 16, Ill.

Apr 25-29—Oil and Gas Power Div, American Society of Mechanical Engineers, meeting, Hotel Sherman, Chicago, Ill. Joseph M Clark, exhibit manager, 29 W 39th St, New York 18.

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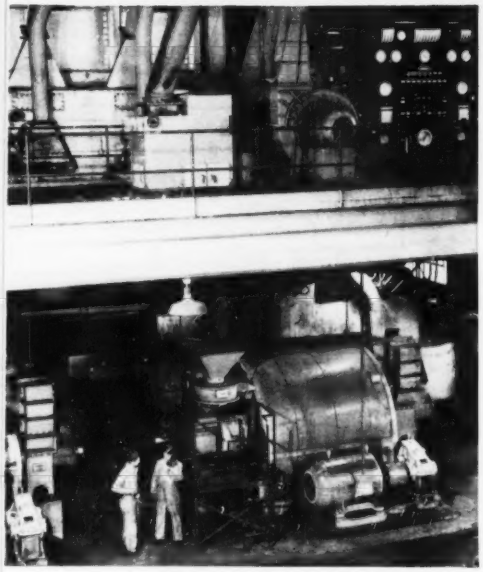

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REVIEWED IN THIS ISSUE

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ELEMENTARY STEAM POWER ENGINEERING • GAS TABLES
TRANSFORMERS: THEORY AND CONSTRUCTION
AMERICAN ELECTRICIANS HANDBOOK • BITUMINOUS COAL FACTS AND FIGURES
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METAL SPRAYING AND SPRAYED METAL • ROTARY VALVE ENGINES
DESIGN OF INDUSTRIAL EXHAUST SYSTEMS • FLUID DYNAMICS

Electricity

AMERICAN ELECTRICIANS HANDBOOK (sixth edition). *By Terrell Croft; revised by Clifford C Carr, head of Electrical Engineering Dept, Pratt Institute, New York, N.Y. 1773 pp, 5x7¾, cloth covered. $6. McGraw-Hill Book Co, 330 West 42nd St, New York 18, N.Y.*

This is an authoritative job-book for those with little electrical knowledge as well as the trained electrician and engineer. Revised edition contains information on electron tubes and circuits; fundamentals of construction, operation and application of electronic devices in industry, control generators (Amplidyne and Rototrol), electronic control of motors, automatic electric-drive control, synchros, dry-type transformers, copper oxide and selenium rectifiers, load-center industrial-distribution system, fluorescent lighting developments and farm wiring.

The previous edition has been carefully checked and revised in accordance with the 1947 edition of the National Electrical Code. Where necessary, data and information have been added to each division to include both latest equipment and present-day practice.

Steam Power

ELEMENTARY STEAM POWER ENGINEERING *(third edition—1948). By Edgar MacNaughton, professor of mech engrg, Tufts College Engineering School. 640 pp, 6x9, illust. $6.50. John Wiley & Sons, Inc, 440 4th Ave, New York 16, N.Y.*

Covering both the practical and theoretical phases, the author explains the fundamental principles that apply to the construction and operation of steam-power equipment. Although intended primarily for men of college grade, mathematical discussion is simple enough to make the text adaptable for vocational schools. Except for one chapter, which uses higher mathematics, the book provides a wealth of easily understood information for the practical engineer with a high-school education.

Typical chapter headings are: Boilers and settings; superheaters, de-superheaters, reheaters and purifiers; fuels and methods of burning; combustion; feedwater conditioning; piping systems; engines and turbines; performance and testing of engines and other subjects that cover the entire power plant. Original material has been thoroughly revised and brought up to date, and new information on thermodynamic principles, turbines and boilers has been added.

Bituminous Coal

BITUMINOUS COAL FACTS AND FIGURES *(1948). By Bituminous Coal Institute. 148 pp, 9x6, 60 tables, numerous illust, paper. Available through Bituminous Coal Institute, Southern Bldg, Washington, D.C.*

Up-to-date information on the bituminous-coal reserves, production, distribution, consumption, mechanization, manpower and other pertinent data make up this 148-page book. An invaluable ready reference on coal for any power man.

There are reports and tables on tonnages, statistics on mechanization, figures on costs, prices, income, labor and investment outlay. The book is copyrighted but permits reprint of any material provided credit is given BCI.

This organization, BCI, intends the book as a statistical-data reference, similar to that issued by the automotive, steel and oil industries.

Transformers

TRANSFORMERS: THEORY AND CONSTRUCTION. *By W C Sealey, engineer in charge of transformer design, Allis-Chalmers Mfg Co, 241 pp, 5¼x8½, illust, cloth $3. International Text Book Co, Scranton, Pa.*

Starting with a review of transformer fundamentals, Mr Sealey outlines transformer principles, magnetic circuit, current and voltage relationships. Connection diagrams with corresponding vector studies and rules for determining polarities are covered, as are equivalent circuits for the 3-winding transformer.

Among the special transformers discussed are those used with unit substations, rectifiers, networks, rotary converters, electric furnaces, street lighting, instruments and relays. Lightning testing, inert-gas systems, tap changing under load, load ratio control, forced cooling, bushing design, dry-type power transformers and radiator construction are fully treated.

This well-written book is an authoritative treatment of the subject.

Gas Tables

GAS TABLES—THERMODYNAMIC PROPERTIES OF AIR, PRODUCTS OF COMBUSTION AND COMPONENT GASES (1948). *By Joseph H Keenan, professor of mechanical engineering, and Joseph Kaye, assistant professor of mechanical engineering, both of Massachusetts Institute of Technology, 238 pp, 7x10; 5 illust, 64 tables. $5. John Wiley & Sons Inc, 440 Fourth Ave, New York 16, N. Y.*

These tables supersede the previous book, *Thermodynamic Properties of Air*, by the same authors. Air properties have been recalculated and those of combustion products of hydrocarbons and constituent gases have been added. Function tables for analyzing compressible-fluid flow have been greatly extended. For engineering application to power equipment, the precision of these tables equals those of modern steam tables. Convenience of the arrangement is better than the steam tables.

By taking the base at 0 F absolute, negative values of properties have been avoided. Properties for air are on the pound basis, for all other gases on the molal basis.

Exhaust Systems

DESIGN OF INDUSTRIAL EXHAUST SYSTEMS *(second edition—1948). By John L Alden, assistant works manager, Western Electric Co, Kearny, N.J. 252 pp, 5½x8½, 120 drawings and diagrams, cloth. $3.50. The Industrial Press, 148 Lafayette St, New York 13, N.Y.*

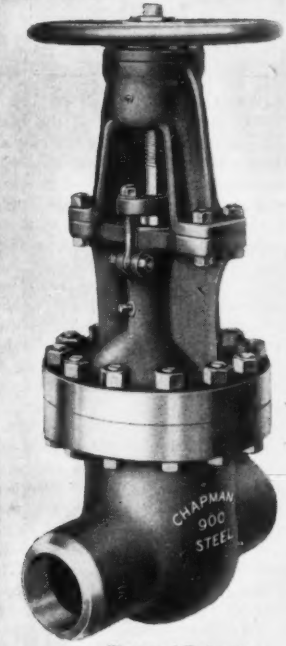
This completely revised version of the author's 1939 work is written to help the reader design, build or buy an exhaust system that performs adequately and economically. The systems it discusses are prescribed by engineers or industrial hygiene specialists to perform definite functions over and above those set by law.

The book covers exhaust ventilation, low-pressure pneumatic conveying, design of hoods, piping and structural details, selection of dust separators, centrifugal- and axial-flow fans. The approach is highly

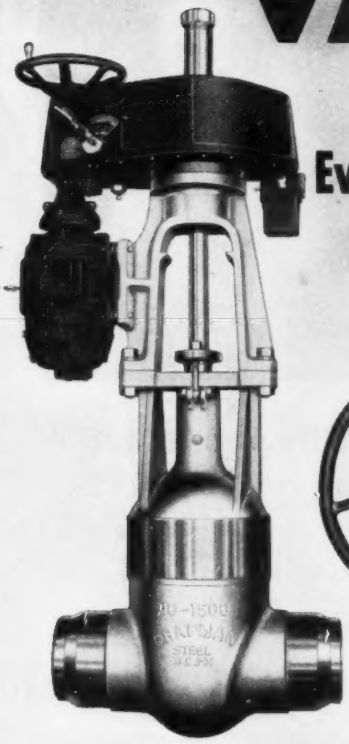
(*Continued on page* 168)

CHAPMAN VALVES

Meet Every Power Plant Specification



Flanged Bonnet



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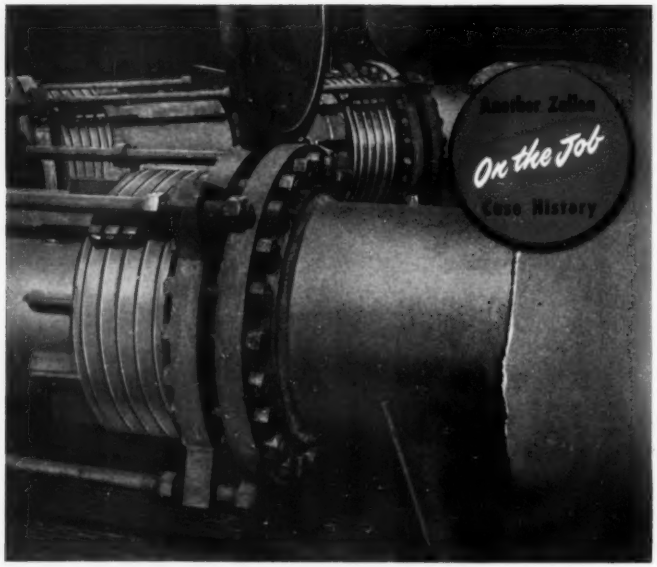

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EXPANSION JOINTS

WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

Electronics

(Continued from page 128)

main transformer.

Both times, one half of the heater section of the transformer winding is in series with a main section of the winding supplying the load and of the same polarity. As a result, voltage applied to the load is the same for each half-cycle. This would not be true if the load connected to one side of cathode only. The reason is that during one-half cycle of rectification, the cathode-heater section of the transformer winding would be in series with the load circuit and on the other half-wave the load circuit would go directly to the cathode.

This procedure also explains why in Fig. 4 and 5 the cathode of each tube is connected to a separate section of transformer winding. When tubes with indirectly heated cathodes are used, both heaters can be connected to the same section of transformer, and one side of the load to both cathodes. This applies to a single- or a duplex-element tube, or to two tubes with indirectly heated cathodes, connected for full-wave rectification.

Pulsating Current. A pulsating current like Fig. 1*b* and 1*c* is suitable for charging storage batteries and for certain other purposes. When pulsations are objectionable they can be partly smoothed out by a capacitor filter connected in the load circuit.

Fig. 9 shows a simple rectifier circuit, similar to Fig. 2 but with a capacitor connected across the load. The load has a high resistance to limit the current to only a part of the tube's rating. When the tube conducts as in Fig. 9, voltage of the dc circuit increases from zero at *A* to a maximum at *B*, Fig. 11. During this period, current flows through the load and the capacitor is charged to the circuit's maximum potential at the polarity shown. During period *BC* rectified voltage drops to zero at *C*.

When the rectifier voltage decreases below that of the capacitor at *B*, the latter begins to discharge through the load, Fig. 10. Until after the rectifier voltage again becomes positive and increased to that of the capacitor the latter maintains a decreasing voltage *BE* across the load, and current continues to flow. During this period current cannot flow from the capacitor through the tube because it would have to flow from anode to cathode. As we know, the tube cannot conduct in this direction.

At *E*, Fig. 11, rectifier voltage on the next positive wave becomes greater than that of the capacitor. Beyond *E* the rectifier again picks up the load and

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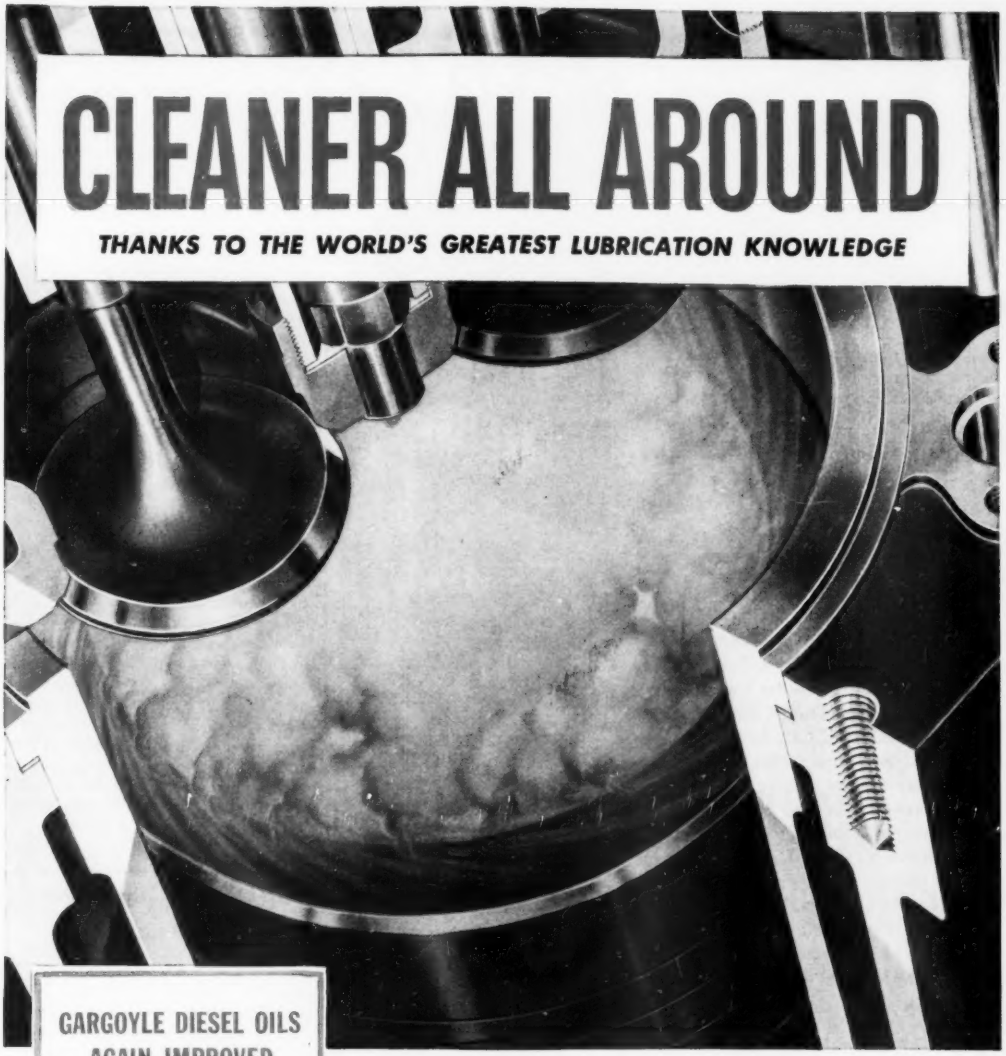

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charges the capacitor to maximum voltage at *F*. From *F* the previous cycle is repeated.

Capacitor Filters. The capacitor across the load acts much as an air chamber does on the discharge of a reciprocating pump to smooth out pressure and flow. During the period of maximum pump discharge, water is stored in the air chamber to be discharged to the system at reduced flow from the pump.

The rectifier, Fig. 9 and 10, requires a comparatively large capacitor and does not give a dc voltage smooth enough for many applications. The latter can be improved by using two tubes, Fig. 4 and 5, or a dual-element tube, Fig. 6 and 7, to rectify both halves of the alternating-voltage wave. This system charges the capacitor twice as frequently, Fig. 12, as for single-element rectification, Fig. 11.

In both figures, line *BE* represents the time the capacitor discharges between dc impulses. It is evident that this time is only about one third as long in Fig. 12 as in 11. Consequently, with the same size capacitor in both systems, voltage ripples are smaller with full-wave rectifiers than with half-wave.

There are many single-phase and polyphase rectified systems in which a capacitor is used as a filter to smooth out the rectified voltage impulses. The ones explained show their general principle.

The next article will discuss other filter arrangements and voltage doublers when using electron-tube rectifiers.

Technical Briefs

(Continued from page 152)

phite liquors remains a problem. There are fundamental researches now in progress on the chemical structure of lignin and lignocellulose molecules that, the author feels, may lead to a solution of the problems. Meanwhile attention is being directed toward development of magnesium-base, ammonia-base, and sodium-base cooking liquors. With them, the problems of byproduct recovery and waste disposal would be greatly simplified.

The author cites several other developments now going on and lists several organizations carrying out research programs on waste-liquid disposal. He also mentions that five companies are now combining for the construction of the first industrial-size plant to develop the biaeration process. *ESWP Paper.*

USE OF ORGANIC CATION EXCHANGERS FOR MUNICIPAL WATER SOFTENING, *by*

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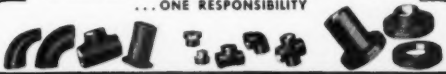

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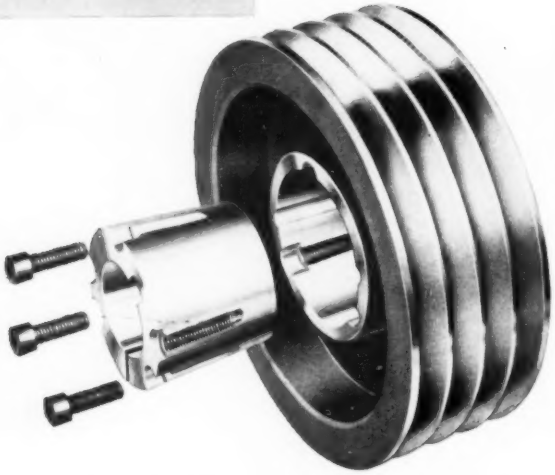

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Silver contacts have permanently attached springs that are easy to remove. Terminals are located on the front and are easy to wire — a screw driver is all you need to disassemble starter — can be accomplished in less than a minute.

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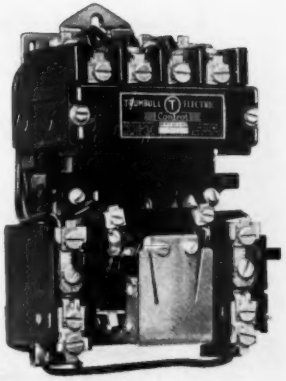
Permanent lubricant impregnated in the plastic coil enclosure keeps magnet guides sliding smoothly . . . eliminates low voltage "chatter."



FOR MORE INFORMATION about this latest Trumbull development, write for Circular TEC 11. THE TRUMBULL ELECTRIC MANUFACTURING CO., Plainville, Conn. Other factories and offices throughout the United States. Foreign representation.

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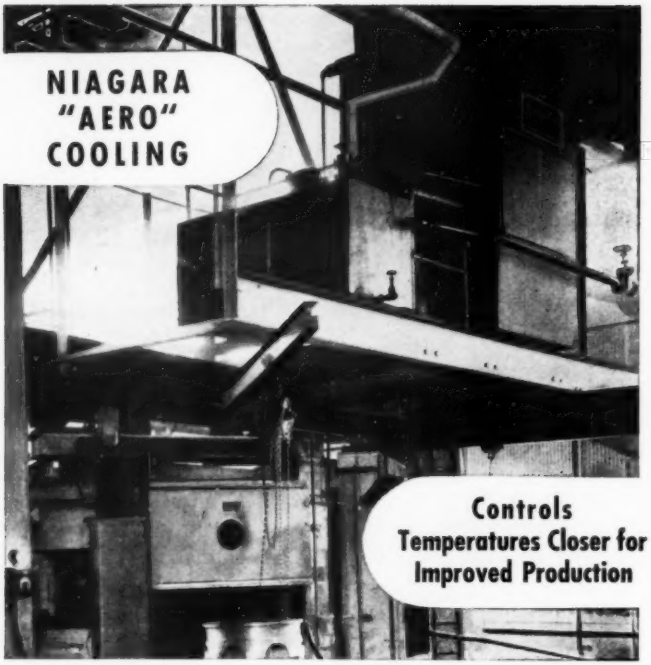

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Wm W Aultman and A E Bowers, Metropolitan Water District of Southern California. A series of tests on organic cation exchangers was conducted with three specific objectives in mind (1) salt efficiency (2) life expectancy of the exchanger (3) effect on the exchanger of low concentrations of chlorine or other oxidizing agents.

In addition the investigations included sieve analyses, bed-expansion data, "break-through" behavior and other factors influencing operating characteristics of organic exchangers. In general, organic cation exchangers now on the market fall into three broad classes—carbonaceous, phenolic polymer, and high-capacity nonphenolic polymer.

Tests indicate a water carrying a chlorine residual does not produce good results with the carbonaceous or the phenolic-base resin exchangers. In the presence of low chlorine concentrations the nonphenolic polymer-base resins show more stability. A further characteristic of these nonphenolic polymers, which has direct economic possibilities for systems like those of the authors, is an ability to operate under semisalt-starvation conditions wthout apparent deleterious effects. *ESWP Paper.*

CIRCULATING-WATER TREATMENT PRACTICE, *by J C Hill, Esso Standard Oil Co.* A concise discussion, bolstered by data and information, shows the benefits derived from an active cooling-water treatment program. Control of algae, scale and corrosion in four cooling systems is described, and unusual experiences with leaking heat exchangers are related. *ESWP Paper.*

Plant Problems

(Continued from page 136)

Move Stack Ten Feet

IT'S BEST for *WA* to move his stack to new concrete base of same size. Anchor new flanged stack base ring into new base when concrete is poured. Allow concrete about a week to set. Meanwhile, guy stack at present location and remove brick work.

If possible move stack 10 instead of 6 ft. Then stack can be moved with crane or derrick directly from old to new base, and riveted or bolted up in short time. Stack should again be guyed up until the brickwork has been rebuilt.

Check stack before moving; it's a very good time to replace the sections that are corroded.

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ENGINEER'S BOOKSHELF

(*Continued from page* 158)

practical but the book is based on solid engineering fundamentals and developments.

Ventilation is an art that has grown rapidly, particularly in recent years. While the basic principles have not changed much the increased knowledge of the toxicity of various solvents, for example, has accelerated the use of axial-flow fans for this service.

AMERICAN STANDARDS FOR TRANSFORMERS, REGULATORS AND REACTORS. *Sponsored by the Electrical Standards Committee and approved by the American Standards Assn, 8x10¾, 96 pp, paper, $4. American Standards Assn, 70 East 45th St, New York 17, N.Y.*

Representing standard practice in the U.S. relating to transformers and other induction apparatus, these data are gathered from many sources, notably the established standards of the AIEE and the NEMA.

This publication contains information relating to the terms and conditions upon which rating and behavior of transformers and other induction apparatus are based. Special reference is made to the conditions under which acceptance tests are made with a guide for operation in service. Definitions are included covering the various types of apparatus coming within the book's scope.

METAL SPRAYING AND SPRAYED METAL *(third edition—1948). By E C Rollason, T Henry Turner and N F Budgen. Rewritten by W E Ballard, managing director, Metallisation Ltd. 362 pp, 6x8¾, 61 tables, 216 illust, cloth. Distributed in the U.S.A. by American Metallizing Contractors Assn, 773 Brownell Ave, St Louis 22, Mo.*

Men with a purely scientific interest in metal spraying have written previous editions of this book. This issue is the work of a man closely connected with the commercial development of metal spraying in England for 24 years.

To achieve his aim of compiling a book that is a guide to both technician and scientist, he gives considerable space to the fundamentals. In addition, the book contains material on the use of compressed gas and subsidiary apparatus. Much of the early part of the book is for the technician. The more highly theoretical considerations take up the sections dealing with the structure and formation of deposits.

At the end of each of the 12 chapters is a list of references to the more relevant literature pertaining to the material covered in that chapter.

SOURCES OF ENGINEERING INFORMATION, *1948. By Blanche H Dalton, 112 pages, 9½x6¼, $4. Published by University of California Press, Berkeley 4, Calif.*

This concise reference book, for students, practicing engineers, research workers and librarians, enables technical men to find

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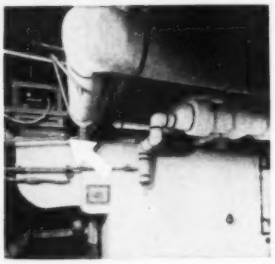

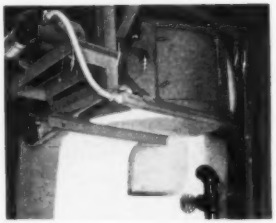

One of New York's many unique hostelries is the famous "Tavern-on-the-Green" in Central Park, to which celebrities from every part of the world eventually gravitate.

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the key to all research in a particular field by turning directly to the topic. The author is librarian of the Engineering Library at the University of California.

ADVANCED DYNAMICS *(1948). By S Timoshenko, professor of theoretical and applied mechanics, and D H Young, professor of civil engineering, both of Stanford University, 400 pp; 6x9; 279 illust, tables. $5.50. McGraw-Hill Book Co, 330 West 42nd St, New York 18, N. Y.*

As the name implies this book covers problems of an advanced nature concerning high-speed machines, vibration theory, balancing ballistics, and gyroscopic study of rockets. General methods of approach to various classes of dynamical problems are developed and illustrated. Included are recent advances in methods of dealing with vibrations of systems having nonlinear spring characteristics, methods of successive approximations in calculating natural frequencies of systems with several degrees of freedom and discussions of various types of dynamical dampers.

FLUID DYNAMICS *(1948). By Victor L Streeter, research professor in mechanics, Illinois Institute of Technology, 263 pp, 6x9, 139 illust, tables. $5. McGraw-Hill Book Co, 330 W 42nd St, New York 18, N. Y.*

Designed for teaching graduate engineering students, this text introduces the classical theory of fluid flow covering the ideal fluid theory for both 2- and 3-dimensional flow as well as the theory of viscous flow. Emphasizing problem solution aids the student in understanding the theoretical material.

The book uses mathematics advanced beyond the calculus. In such cases the advanced techniques are demonstrated by derivation and application.

ELEMENTARY INDUSTRIAL ELECTRONICS (1948) *By William R Wellman, co-chairman, radio department, George Westinghouse Vocational High School, New York City. 371 pp; 6x9 in.; illust; cloth, $4. D Van Nostrand Co, 250 4th Ave, New York 3, N. Y.*

Electronics, the art of producing and controlling free electrons, has invaded power and industrial fields so rapidly that many engineers find themselves face to face with electronic devices, which they must operate but of which they have little knowledge. This book will meet their needs, as well as help others who are looking for a basic understanding of electronic devices and how they work. Scope and method of presentation are such that the book is of particular interest to the beginner rather than the more advanced student or engineer.

An introduction outlines the major applications of electronics in non-technical terms. This is followed by a chapter on ac fundamentals, with which electronic principles are closely associated. Remainder of the book deals with electron tubes, their principles of operation, and the circuits and devices where they are used, such as rectifiers, amplifiers, high-frequency heating, control of motors and generators, control of resistance welding

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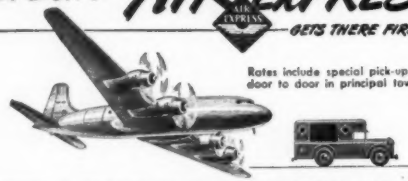

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and photoelectric devices. A chapter on electronic lighting describes a wide variety of equipment used in these applications.

STEAM, AIR AND GAS POWER *(4th edition, 1948) By William H Severns, Prof of ME, University of Illinois, and Howard E Degler, Technical Director, Marley Co, and former Prof of ME, University of Texas. 509 pp, 6x9, cloth $4.75. John Wiley & Sons, 440 Fourth Ave, New York 16, N. Y.*

This new edition of a familiar text on basic heat-power engineering has been brought up to date by inclusion of material relating to modern practice in the field. Discussion and illustrations show underlying theory of construction, application and performance of power plants. Most of the carefully chosen problems are new in this edition. Material on the gas turbine represents an important addition to this edition.

ROTARY VALVE ENGINES (1948). *By Marcus C Inman Hunter. 216 pp, 5x8¼, cloth covered. $5. John Wiley & Sons Inc, 440 Fourth Ave, New York 16, N. Y.*

In this, the first book devoted entirely to the rotary valve, the author traces the history of its development and illustrates the numerous applications of rotary and semi-rotary systems to both old and modern engines. Throughout he emphasizes the ways to combat friction, chief problem of this design.

The author believes that the rotary valve challenges the supremacy of the poppet designs used on the majority of internal-combustion engines today, and that it will be used more extensively on high-speed engines. His statement of the case for the rotary valve and his practical points in connection with its design should make this book interesting to both engine designers and students.

DIESEL ENGINE CATALOG *(Volume 13, 1948). Edited by Rex W Wadman. 454 pp, 10x13½, cloth covered, heavily illustrated. $10. Diesel Engines, Inc, 2 West 45th St, New York 19, N. Y.*

This annual publication gathers in one convenient place catalog information on the diesel engines manufactured in the U. S. The complete line of each builder is described, with cross sections and illustrations of construction features. Size, speed and other pertinent data are tabulated for each line.

An accessory section supplies similar information on fuel-injection equipment, hydraulic couplings, chain drives, superchargers and blowers, cooling equipment, valves and valve adjusters.

Such a compilation proves valuable to engineers and potential diesel users desirous of securing information on all current engine types with maximum convenience.

ELECTRIC TRACTION FOR CRANES. *By Richard A West, 86 pp, 5¾x8¾, cloth. $3.50. Sir Isaac Pitman & Sons Ltd, London, England. Available through Pitman Pub Co, 2 West 45th Street, New York 19, N.Y.*

Increasing speed with decrease in load is one of the characteristics of the series motor; this book shows how best use can

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be made of it. While the text centers around requirements of the long travel motion of the steel-mill crane bridge, occasional reference is made to auxiliary crane motors where the author felt the need existed.

Mr. West attempts to bring together the mechanical and electrical details necessary for an electrical engineer to make a suitable recommendation of hp and geared speed for the driving motor.

Definite recommendations have been made based on the author's experience. Considerable explanatory detail is included so other opinions can be interpolated, based on the fundamental principles outlined.

FORMING OF AUSTENITIC CHROMIUM-NICKEL STAINLESS STEELS. *Assembled and edited by Vsevolod N Krivobok, Sc D, The International Nickel Co Inc, and George Sachs, D Eng, Case Institute of Technology, 309 pp, 8¼x11, 200 illust, cloth, $4. Published by The International Nickel Co Inc, 67 Wall St, New York 5, N.Y.*

Compiled to afford fabricators of metal equipment a better understanding of the unusual adaptability of stainless steels to all modern processes of forming. This book presents a detailed description of the modern forming procedures applied to chromium-nickel stainless steels as practiced in the fabrication plants of the U.S. The principal stainless-steel producers and fabricators cooperated with The International Nickel Co, Inc, and provided full information not hitherto exchanged, making possible this unusual technical and practical volume.

Bending and straight flanging, forming of curved sections and tubing, deep drawing, die forming, forming of contoured-flanged parts, and forming by miscellaneous methods are some of the processes discussed. The specific examples of forming technique are supplemented by details of tool design and tool materials, information on lubricants, data on dimensions, and a listing of consecutive steps in fabrication.

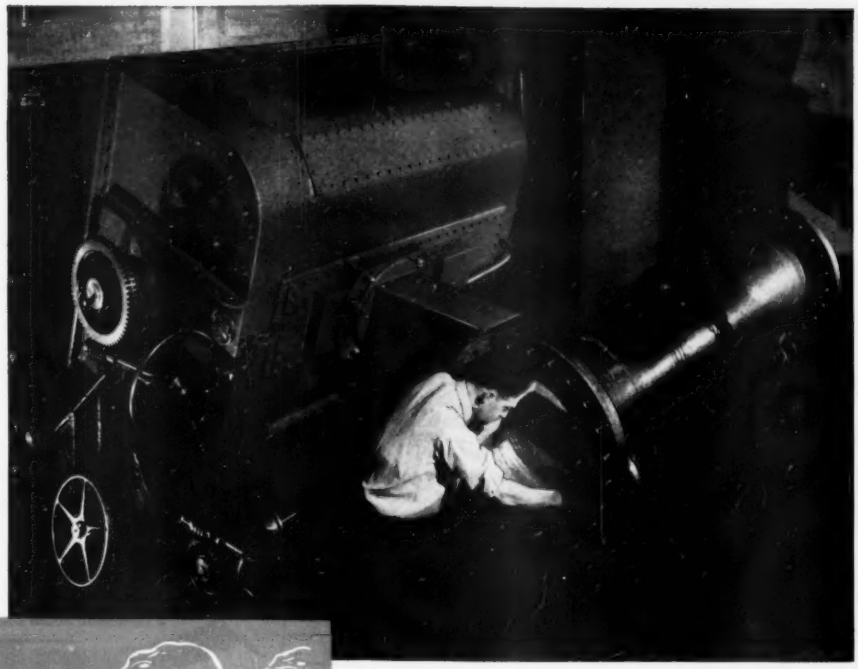
Texas Plant

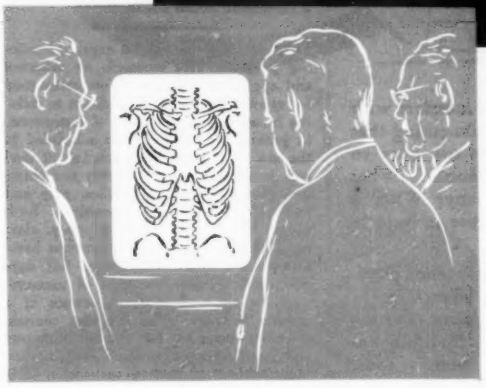
(*Continued from page 75*)

some means of energizing these auxiliary motors had to be provided until the main generators could be brought up to speed and put on the line. With no outside tie-in planned, the installation of a small auxiliary generator was the answer.

Important considerations in selection of this unit were: delivery time, investment, space, capacity, type of prime mover and output voltage. We obtained a suitable 1000-kw 250-psi turbine-generator designed to operate either condensing or noncondensing, and with an output potential of 440 v. Using this unit and a small engine-driven well pump, we were able to get the large units on the line, with the following general procedure.

Boilers were filled with water using





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the engine-driven well pump. Then a gas burner was lighted and boiler operated on natural draft. When steam pressure rose beyond the feed pressure of well pump, a turbine-driven boiler feed pump was started. With pressure about 250 psi, the 1000-kw unit was started, exhaust steam being vented to atmosphere.

Voltage was built up on the 1000-kw unit and the switch closed to the 440 v station bus. Induced-draft fan and other necessary auxiliaries were then started. Additional burners were lit and the boiler prepared for greater load. Switch to the power-house substation was closed and the power back-fed to the 13,800-v distribution system, making it possible to transmit power to intake transformers and to energize one of the 300-hp cooling-water pumps.

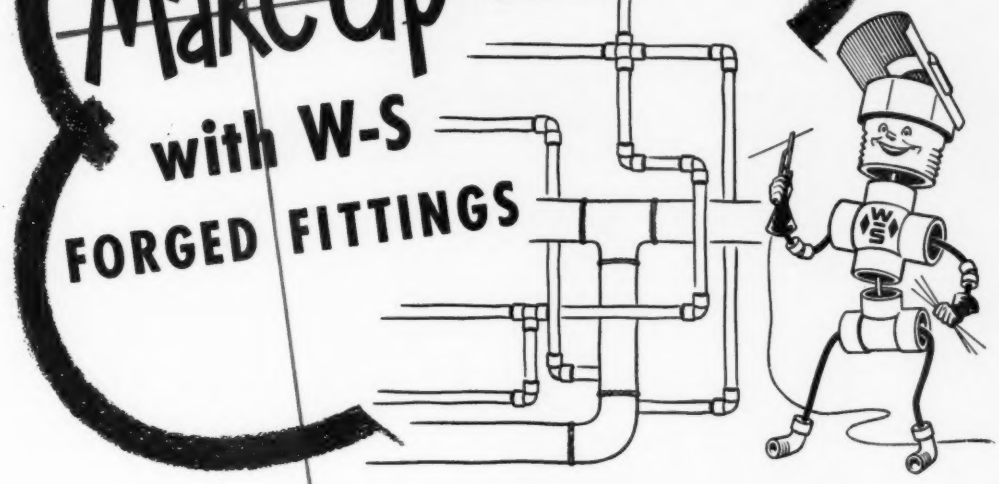
Cooling water was now available and the 1000-kw unit was placed in condensing operation. Pressure of 250 psi was maintained on the 1000-kw unit through a reducing station, and pressure in boiler was raised to point where a main generator could be started and synchronized into the system. The 1000-kw turbine-generator was then shut down to serve either as an emergency unit or to assist later in maintaining a favorable steam balance.

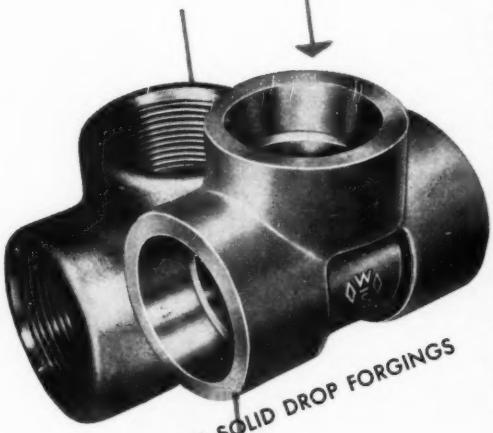
FOXBORO CO announces an expanded training program, with emphasis on selection and application of correct instrumentation for specific industries, in addition to training in use and maintenance of instruments in general. Courses already scheduled in the new program, which began Jan 10, deal with instrumentation in refinery and chemical process industries, textiles, pulp and paper, food and wood processing. Each course includes two weeks of study, class work and shop practice with various basic instruments, followed by three full days devoted to special problems of measurement and control in the processes of a specific industry. The training courses, primarily intended for process engineers and instrument maintenance men, are offered without charge to such men when sponsored by their respective companies. The courses are not for beginners, nor offered as an employment medium. Enrollment is limited and applications should be made well in advance. Write to Director of Training, Foxboro Co, Foxboro, Mass. for full information.

I Want to Know About the Electric Industry is the title of a new information booklet published by Edison Electric Institute. Subtitled *the answers to 24 questions frequently asked the Institue*, it consists primarily of single-page presentations of each question, with a brief answer, and tabular and explanatory material for a more extended answer to the question posed. Collectively, the answers to the questions give a short but comprehensive story of the electric industry today, in convenient ready-reference form. Booklet is available on application to Edison Electric Institute, 420 Lexington Ave, New York 17.

Make Up with W-S FORGED FITTINGS

AN ALL-STEEL SYSTEM





MACHINED FROM SOLID DROP FORGINGS

There's sound planning in the little man's suggestion. He uses W-S Forged Steel Fittings below the practical butt-welding range . . . and has an *all-steel* system.

He does the whole job with *one* method by using W-S Socket Welding Fittings in nominal sizes from 2" down to ¼" . . . conveniently *welds all the way*. Then, where accessibility or other limiting factors require a screwed connection, he maintains the strength and uniformity of an *all-steel* service by using a W-S Forged Steel Screw End Fitting.

The little welder knows that *forged steel* is the toughest fitting material available, and that *forged* fittings are lighter, smaller, stronger and more uniformly free of flaws than any other kind. That's why they're *cheaper*, too . . . he puts 'em in and forgets 'em!

Write for Bul. A-3: Watson-Stillman's complete lines of Forged Steel Screw End and Socket Welding Fittings *for all services*. Prompt delivery.

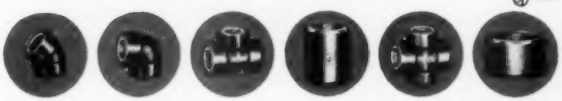
CARBON STEEL
Low Sulphur, Low Phosphor
High Tensile, High Weldability

ALLOYS
Stainless types 304—316—347
Chrome Moly—Carbon Moly—
Chrome Carbon Moly—Monel
Special alloys for Low Temperatures

WATSON-STILLMAN

ROSELLE, NEW JERSEY

ESTABLISHED 1848

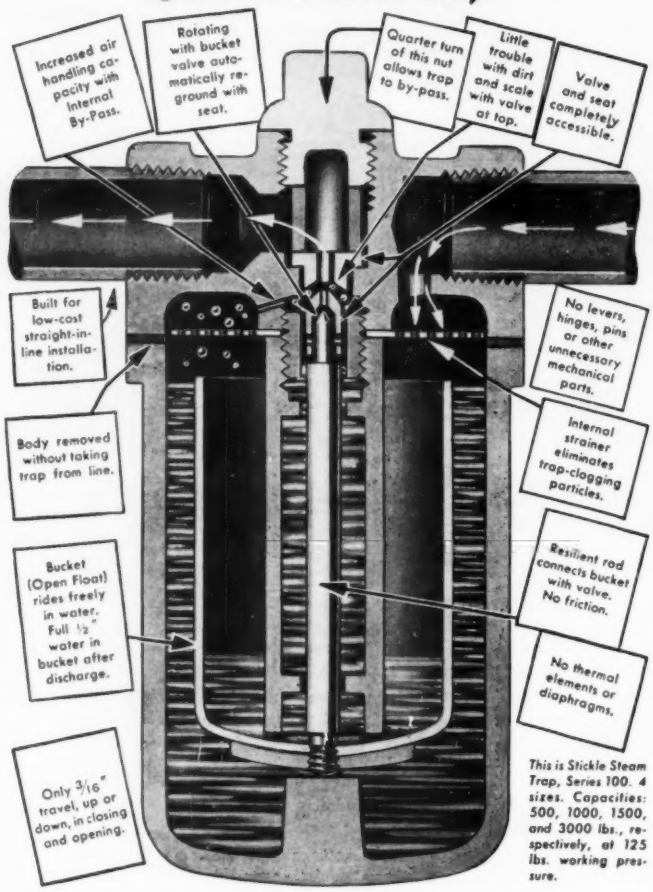


SOLD THROUGH LEADING DISTRIBUTORS

PERFORMANCE

MET IN STICKLE DESIGN AND CONSTRUCTION

Check the Reasons Why!


Increased air handling capacity with Internal By-Pass.
Rotating with bucket valve automatically re-ground with seat.
Quarter turn of this nut allows trap to by-pass.
Little trouble with dirt and scale with valve at top.
Valve and seat completely accessible.
Built for low-cost straight-in-line installation.
No levers, hinges, pins or other unnecessary mechanical parts.
Body removed without taking trap from line.
Internal strainer eliminates trap-clogging particles.
Bucket (Open Float) rides freely in water. Full ½" water in bucket after discharge.
Resilient rod connects bucket with valve. No friction.
No thermal elements or diaphragms.
Only 3/16" travel, up or down, in closing and opening.

This is Stickle Steam Trap, Series 100. 4 sizes. Capacities: 500, 1000, 1500, and 3000 lbs., respectively, at 125 lbs. working pressure.

ASK FOR BULLETIN No. 115, or state drainage problem for recommendation. The Stickle Open Float principle of construction is basic to Stickle Traps. Made in series designs to meet specific conditions of operation with high, medium, and low pressures and on vacuum.

STICKLE STEAM SPECIALTIES COMPANY
2265 Valley Avenue, INDIANAPOLIS 18, INDIANA

Successfully Serving for More than 40 Years Paper Mills, Food Processors, Textile and Hosiery Mills, Laundries and Other Manufacturers Using Steam for Industrial Processing

STICKLE EQUIPMENT

STICKLE DIFFERENTIAL AND BOILER RETURN SYSTEMS • STICKLE OPEN FLOAT STEAM TRAPS • STICKLE REGULATING AND REDUCING VALVES • STICKLE OPEN COIL FEED WATER HEATERS AND PURIFIERS • STICKLE OIL AND STEAM SEPARATORS STICKLE TEMPERATURE CONTROLLERS AND OTHER SPECIALTIES

New Equipment

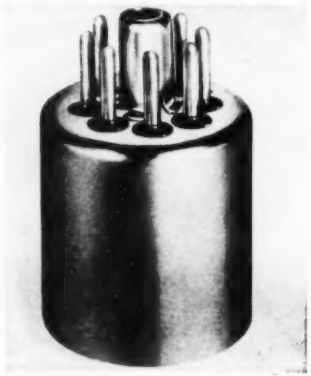
(*Continued from page* 148)

in one rating, 0-90 to 130 v, meter can be supplied with scale applicable for use with potential transformers. **General Electric Co., Schenectady 5, N. Y.**

Battery Indicator E14

BATTERY CHARGE INDICATOR shows momentary charge condition of industrial truck batteries. By showing state of discharge at any instance, possibility of overdischarging battery is reduced.

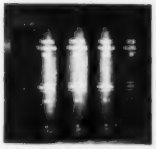
Indicator is marked in four sections, each showing state of charge. Device may be used with 3-, 6-, 12-, 15-, 16-, 18- and 24-cell batteries; a series of resistors and taps being arranged to permit desired adjustment. Case is designed to prevent tampering by truck operators. **Gould Storage Battery Corp, Trenton 7, N. J.**



Sealed Relays E9

ANY TYPE OR SIZE RELAY made by this manufacturer can now be hermetically sealed or dust-tight sealed with a removable cover. Following enclosures are available: pressure-sealed plugs, octal plug-in

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.



Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.

Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.

Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.

This fellow starts where the shop leaves off!

THIS welder is on a job site—in a power house far from Kellogg's plant. He's only one of a crew installing power piping which Kellogg prefabricated. But what he and his partners do, away from the critical eyes of the plant metallurgists and technicians, will go a long way toward determining whether the new piping being welded into position stands up to its "built-in" performance possibilities.

Faulty metal formations can on occasion flow from the end of any welding rod . . . locked-up stresses can be established through carelessly controlled heat treating practices . . . even the fitters, who install the temporary supports before welding can cause damaging stresses in this piping that came through plant inspection with flying colors.

Only experience and knowledge of "what not to do" and expert supervision can preserve the basic qualities built into that piping at the plant. And that should be reason enough for purchasers to consider carefully the relative efficiency and quality of installation forces *before placing orders for critical power piping.* For in essence these installation crews establish final performance of installed piping.

The high repute in which Kellogg installation work is held is the result of more than thirty years of daily association with power piping of all types.

It is the result of knowing where and how to apply positive checks of quality!

It is the result of building over the years a force of supervisory personnel capable of assimilating the pertinent metallurgical information uncovered with each additional day's experience.

It is the result of manning each job with trained, tested and experienced piping engineers, welding inspectors, and stress relieving technicians.

It is all of these plus a management approach which demands that Kellogg piping *in the power line* retain every performance property built into it *at the fabricating plant.*

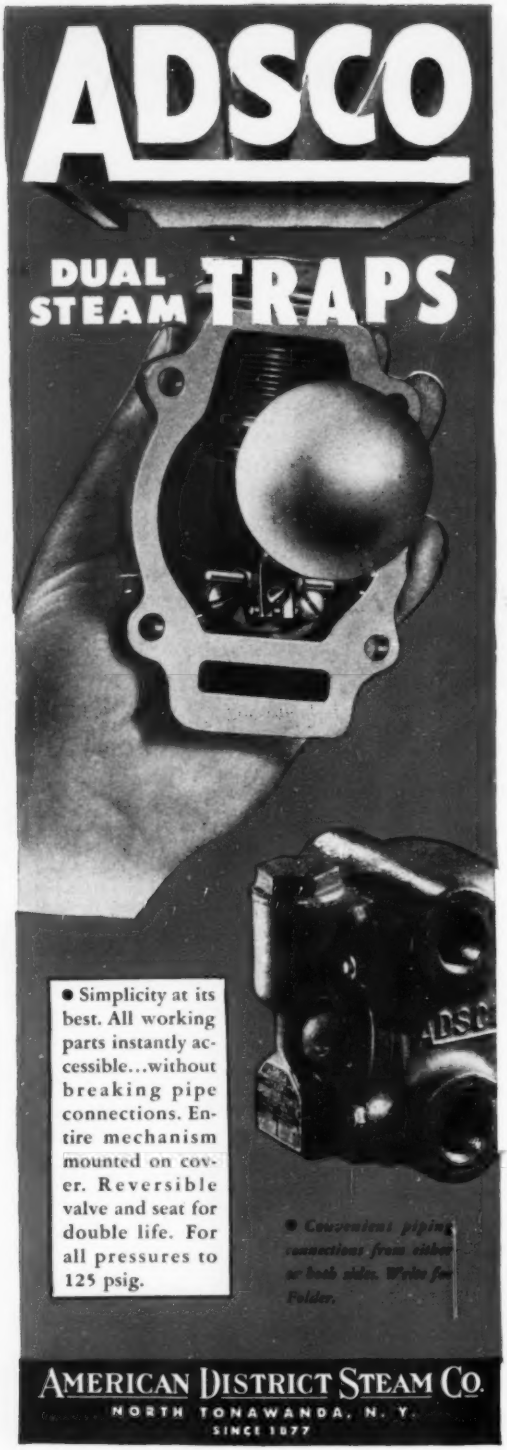
FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY

A SUBSIDIARY OF PULLMAN INC.

NEW YORK • JERSEY CITY • BUFFALO • LOS ANGELES
TULSA • HOUSTON • TORONTO • LONDON • PARIS

VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING
PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS


ADSCO
DUAL STEAM TRAPS
• Simplicity at its best. All working parts instantly accessible...without breaking pipe connections. Entire mechanism mounted on cover. Reversible valve and seat for double life. For all pressures to 125 psig.
• Convenient piping connections from either or both sides. Write for Folder.
AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N. Y.
SINCE 1877

ADSCO
Representatives in following cities.

ALABAMA
Birmingham 3-1495
CALIFORNIA
Los Angeles, Capitol 1-2125
San Francisco, Exbrook 4000
COLORADO
Denver, Keystone 5111
Grand Junction 2242
Pueblo 2085
GEORGIA
Atlanta, Lamar 3871
ILLINOIS
Chicago, Andover 7050
INDIANA
Indianapolis, Riley 1926
IOWA
Cedar Rapids 3-3527
Davenport
Des Moines 4-3331
KENTUCKY
Louisville, Cypress 6336
LOUISIANA
New Orleans, Ray. 7984
Shreveport, 7-7741
MASSACHUSETTS
Boston, Hubbard 2-8352
Longmeadow, Springfield 2-6382
MICHIGAN
Detroit, Tyler 7-6322
Kalamazoo 3-2567
MINNESOTA
Duluth, Melrose 3394
St. Paul Garfield 5811
MISSISSIPPI
Jackson, 4-7689
MISSOURI
Kansas City, Har. 1737
St. Louis, Forest 0400
NEBRASKA
Omaha, Jackson 7636
NEW YORK
N. Y., Penn 6-0277
Syracuse, 4-8597
NORTH CAROLINA
Charlotte, 3-7726
NORTH DAKOTA
Fargo, 4291
NEW MEXICO
Albuquerque, 5584
OHIO
Cincinnati, Univ. 0422
Cleveland, Prospect 4108
Columbus, Evergreen 7839
Dayton, Fulton 9114
Middletown, 2-6367
OKLAHOMA
Tulsa 4-2908
OREGON
Portland, Atwater 3875
PENNSYLVANIA
Philadelphia, Locust 4-2090
Pittsburgh, Atla. 6083
RHODE ISLAND
Providence, Dex: r 4790
SOUTH CAROLINA
Greenville, 2538
SOUTH DAKOTA
Sioux Falls, 2811
TENNESSEE
Knoxville, 3-9219
TEXAS
Dallas, Harwood 5271
El Paso, Main 1787
Houston, Hadley 9574
Lubbock, 2-4330
San Antonio Lambert 2-9481
UTAH
Salt Lake City, 4-6421
WASHINGTON
Seattle, Elliot 4425
WISCONSIN
Milwaukee, Kilb. 8210
WYOMING
Casper, 1856
MANITOBA, CAN.
Winnipeg, 23-341
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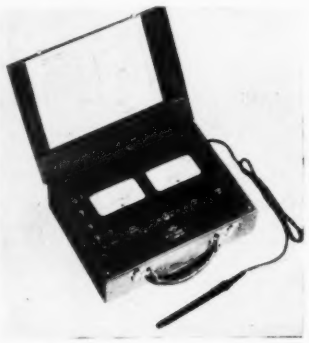
HAWAII
Honolulu, 6401
PUERTO RICO
San Juan, 2-8475
ARGENTINE
Buenos Aires, Belgrano 964
MEXICO
Mexico City, 18-58-08

type, solder lug or screw terminal type. Relays can also be vacuum sealed for special requirements. **Advance Electric & Relay Co, Los Angeles, Calif.**

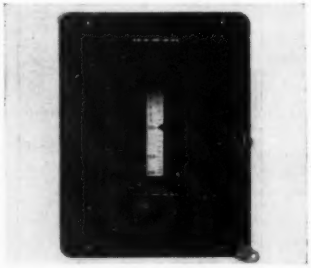
Hydrogen Electrode E23

LOW HYDROGEN-COATED ELECTRODE for welding high-carbon, high-sulphur, and other hard-to-weld steels gives welds without underbead cracking, according to its manufacturer. This electrode has a smooth and steady arc, said to insure good root penetration, and high ductility. Weld has tensile strength of 94,000 psi, yield point 85,000 psi and 26% elongation in 2 in. No. 90-*PL* is available in 3/32, ⅛, 5/32, 7/32 and ¼ in. diameters for use with dc only. **Hobart Brothers Co, Hobart Square, Troy, Ohio.**



Flux Meter E11

DEVICE PROVIDES SIMPLE, complete means of measuring ac, dc and transient magnetic flux densities. Standard range is 0 to 26,000 gauss. Device may be used for checking strength of field when magnetizing permanent magnets, checking field strength and distribution on motors and generators, determining proper shunting in the pole field and determining extent of field distortion because of armature reaction. **Associated Research, Inc, 231 S Green St, Chicago 7, Ill.**



Air-Fuel Ratio Controller E20

AUTOMATIC OR MANUAL VARIATION of fuel to air ratio can be achieved with a dial-control. A four-to-one range results from dial changes under the action of a knob. For automatic control a change in fuel

BWH
DEPENDABLE RUGGEDNESS
BOSTON WOVEN HOSE & RUBBER CO.
CONCORD
STEAM #10
BOSTON, MASS.
BWH
MADE IN U.S.A.
1. Tough, long-wearing, abrasion-resistant cover.
2. Asbestos braid insures maximum cover adhesion, and includes NEW type static conducting wire.
3. High-tensile steel wire for strength, for safety.
4. Heat & oil resistant tube.

NEW! SUPER-FLEXIBLE! SAFE!

AMAZING BWH WIRE BRAID STEAM HOSE

Here's the armored steam hose you've been looking for! It's dependably rugged, and it satisfies the most rigid safety requirements. That's because BWH technologists have spared neither time nor effort in making Concord #10 Steam Hose the best hose of its kind we've ever produced. Here are 6 reasons why this hose will serve you better:

1. The heart of the hose is the same dependably strong rubber tube that has won fame for extra service in BWH BULL DOG Steam Hose.
2. It's muscled with braids of high-tensile steel wire, resistant to heat and high pressure.
3. An open braid of asbestos next to outer wire braid assures perfect cover adhesion.
4. An entirely new method of static control is the crossed wire braiding in the asbestos section — every length tested.
5. The cover is extra tough to resist abrasion, specially designed to resist high temperatures.
6. Because no cotton duck is used, Concord #10 gives longer service on constant pressure steams.

This new hose is extra flexible, too. In fact, Concord #10 is the most modern hose you're likely to find for refineries, core drilling and other high pressure jobs.

From a safety standpoint, Concord #10 rates tops. "Flash" explosions can't happen, because little whispers of steam seep out indicating replacement is necessary. There can't be any sudden bursts to cause injuries to workmen or result in expensive shut-downs.

When you need steam hose that's lightweight, flexible, rugged and SAFE, think of BWH Concord #10. It's your best bet . . . the safest we've ever made!

☆ ☆ ☆

HAVE YOU A JOB WHERE STAMINA COUNTS?

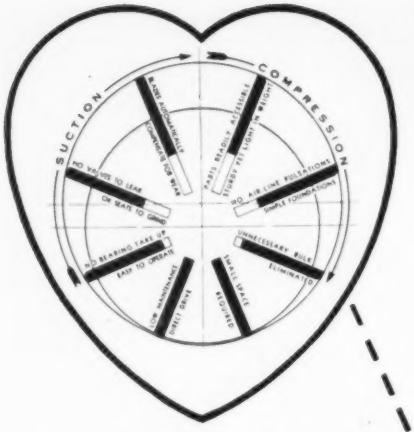
Bring us your toughest problems. We're specialists in solving them. For all industrial rubber needs, look to BWH products for dependable ruggedness, to BWH distributors for dependable service.

Another Quality Product of

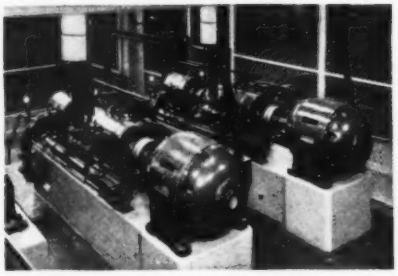
BOSTON WOVEN HOSE & RUBBER COMPANY

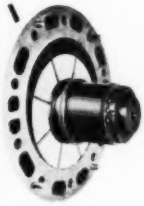
Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS., U.S.A. P.O. BOX 1071, BOSTON 3, MASS., U.S.A.



the HEART of the *Fuller Rotary Compressor*





There are innumerable reasons why Fuller Rotary Compressors are being installed in many fields of industry. The one outstanding factor is, "The Heart of the Rotary", the inherent advantage peculiar to continuous motion, with the consequent absence of pulsations and vibration; minimum number of working parts. This unequalled mechanical simplicity provides for sustained efficiency, and relief from maintenance annoyance and labor costs.

Their extraordinary capacity, with relation to size, makes them readily adaptable for use where space is limited; also installation of separate compressors at the point of air consumption. In other words: "Spot your compressors where you need the air". Such installations offer many advantages and savings when compared with a large central compressor plant, with its attendant network of plant air lines and consequent losses.

Fuller Rotaries are built for capacities to 3300 c.f.m., 125-lb. pressure. Write for Bulletin C-5, which fully illustrates and describes these machines.

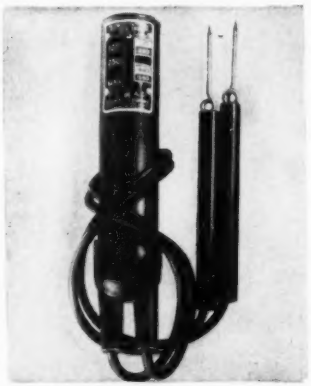
FULLER COMPANY
CATASAUQUA—PENNSYLVANIA

Chicago 3 - 120 So. LaSalle St.
San Francisco 4 - 420 Chancery Bldg.

C-182

A LIFETIME OF NEW MACHINE EFFICIENCY

flow produces a change in the ratio controller that brings air flow to its new value in proportion to air at the new full rate. **Leeds & Northrup Co, 4911 Stenton Ave, Philadelphia 44, Pa.**



Voltage Tester E12

TWO VOLTAGE TESTERS, similar to Catalog No. 5000 that has been manufactured for the past several years, are now available for measuring voltage in high-frequency ac systems and new low-voltage systems.

High-frequency alternating system tester operates on systems ranging from 110 to 550 v, ac, 400 cycles, and 30 to 120 v, dc. Low-voltage tester is suitable for systems ranging from 12 to 60 v, ac, 60 cycles, and 10 to 40 v, dc.

Spear points on test leads allow operator to piece insulation for voltage measurement without damaging insulation. **Square D Co, 6060 Rivard St, Detroit 11, Mich.**

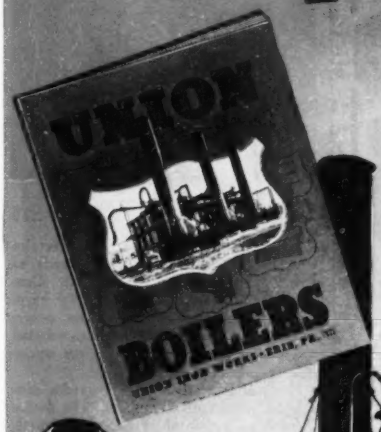
Small Gasoline Engine E74

COMPACT 2-CYCLE GASOLINE ENGINE, developing 4 bhp and weighing only 30 lb, has die-cast aluminum parts for light weight combined with long life and easy handling. Speed is 4500 rpm, cylinder dimensions 2x2 in. Unit was designed for application to portable generators, saws, fire-fighting pumps, compressors, conveyors, etc.

Air-cooled design features a diaphragm

UNION "O" TYPE BOILERS

ONE OF 13 TYPES COVERED *in this book*



THE UNION TYPE "O" BOILER is particularly adapted to oil or gas firing as the tube curvatures provide a large furnace volume and side wall water walling without using headers or circulating tubes.

They are low in cost since the pressure element consists of a single upper and lower drum.

Compactness and absence of dead gas pockets have been secured without sacrificing performance, accessibility or ease of cleaning.

These units can be installed with settings constructed of refractory or tile insulation and steel casing.

Write Union Iron Works, 191 Cascade St., Erie, Pa. for booklet on Union's 13 basic boiler designs.

UNION IRON WORKS • ERIE, PA.

Since 1890

BOILERS — PROCESS EQUIPMENT — FABRICATED STEEL

10 REASONS WHY

UNIT TRAPPING IS PRACTICAL

with Nicholson Expansion Steam Traps

For ALL EQUIPMENT USING STEAM or HOT WATER

Below are some typical applications of this widely used Nicholson trap:

Radiators
Separators
Paper Machinery
Pipe Coils
Kettles
Railway Coaches
Dry Kilns
Vulcanizers
Switch Heaters
Laundries
Plastic Molding Presses

1) Low cost makes unit-trapping economical.
2) Easily installed, usually without supports.
3) Easily adjusted for any pressure from 0 to 250 lbs. without change of valve or seat.
4) Valve is adjustable for regulating temperature of condensate.
5) Entirely automatic action.
6) Quiet, continuous discharge.
7) Discharge air as efficiently as water.
8) No air-binding; no freeze-ups.
9) Hardened stainless steel valve and seat.
10) In various overall lengths: 18" to 40".

Catalog 448 or see Sweet's

W. H. NICHOLSON & CO., 125 Oregon St., Wilkes-Barre, Pa.

"TOPS" by EVERY TEST

Capacities to 150 G.P.M. — Heads to 600 Ft.

The APCO TURBINE-TYPE PUMP

- Simple — Wear-Free — Compact
- High Efficiency
- Silent Operation
- Will not Vapor-Bind
- Hydraulically Balanced
- Accessible
- High Suction Lift
- No Metal-to-Metal Contact
- High pressure per stage
- Double Suction
- Precision Shafts
- Two Outboard Ball Bearings
- Right or Left Hand Operation
- Replaceable Cover Plates

APCO is the highest development of the Turbine-Type Pump. No Metal-to-Metal contact. Handles NON-LUBRICATING liquids almost indefinitely without wear. Applicable for Water Supply, Boiler Feed, Condensation Return, Circulating, Transfer, Booster, Self Priming, Marine, Distillery, Dairy, Special Metal and "1001" Duties. Delivers with slight change in capacity against drastic head conditions.

AURORA CENTRIFUGAL PUMPS

A complete line, notable for streamline coordination between impellers and shells, including Horizontally Split Case, Single and Two Stage, Side Suction, Vertical, Non-Clog, Sump, Mixed Flow, Deep Well Turbines. Special Design, etc.

Write for **CONDENSED CATALOG "M"** *or*

SEE OUR CATALOG IN SWEET'S

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS — **AURORA PUMP COMPANY**

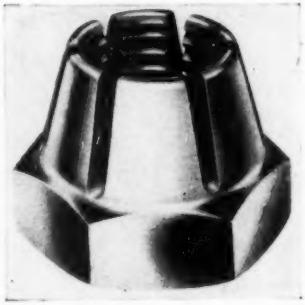
50 Loucks Street, AURORA, ILLINOIS

carburetor that assures a steady supply of fuel regardless of engine position. Passage in crankcase and front cover permits unburned fuel to return to carburetor, eliminating danger of flooding or overloading. Anti-friction bearings protect all rotating parts from wear. **Dept E-18, Reed-Prentice Corp, Worcester 4, Mass.**

Load Regulator E15

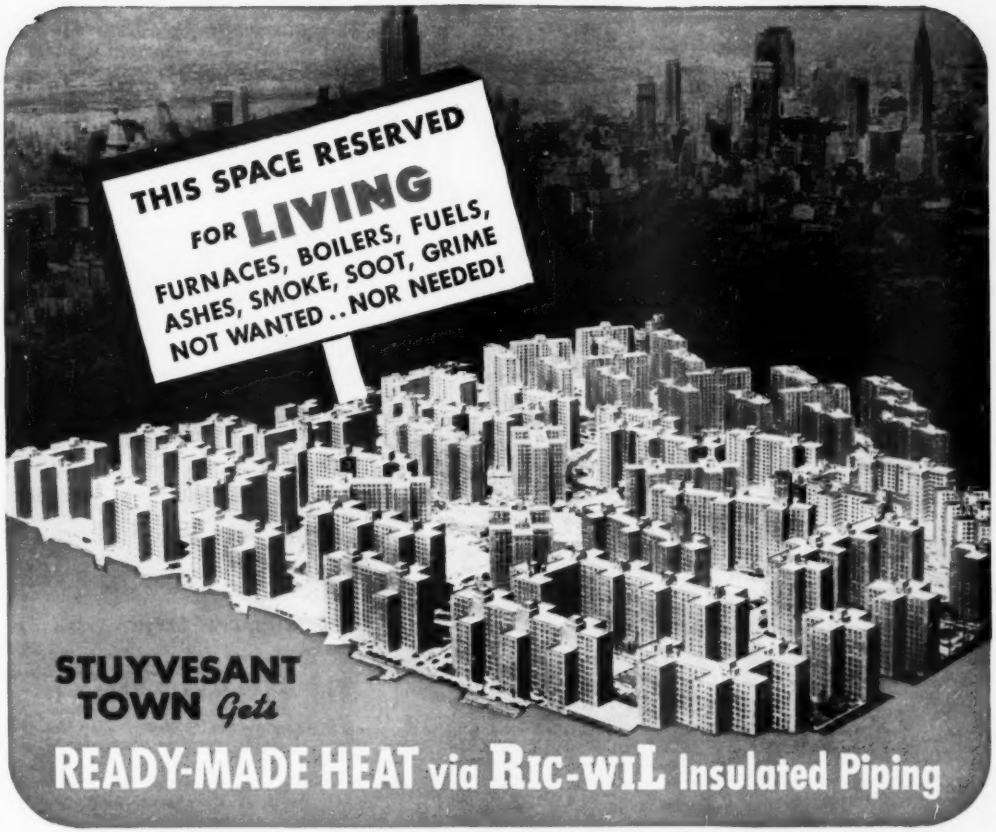
ELECTRONIC LOAD CONTROL is for service with all motor-operated devices, such as pulverizers, pumps, extruders, etc. Constant motor load is maintained by regulating input feed. Variable time delays and a variable dead zone are incorporated to eliminate hunting and to assure operation at maximum output.

Flexitrol is available in one model suitable for motors of all ratings. The device operates on 115 v, 60 cycles, and is available in either explosionproof or standard sheet-metal housing. **G. C. Wilson and Co, 2 N Pacific Ave, Chatham, N. J.**



Self-Locking Unit E76

SELF-LOCKING NUT, good for a temperature range from minus 65 to plus 1200 F, provides permanent protection against vibration, impact, and stress reversal in fully seated and positioned settings. The *Z*-1200 series is particularly suited for exhaust-manifold system, gas-turbine tail cones, and other installations where high temperature creates strength and seizure problems in ordinary fasteners. The *ZE* line provides a nut that withstands sustained temperatures up to 550 F without seizing the bolt or galling the threads, even after repeated exposure to these temperatures. The elastic deflection built into locking beams of both the *ZE and Z*-1200 series makes it possible to reuse the nuts interchangeably, because design assures locking torque within tolerance range of Class 3 bolts. *ZE* and *Z*-1200 series are available in either hex or anchor



● Yes, everything's right here for the 32,700 people who are housed in this modern, mid-Manhattan community. That's the way the Metropolitan Life Insurance Company planned it.

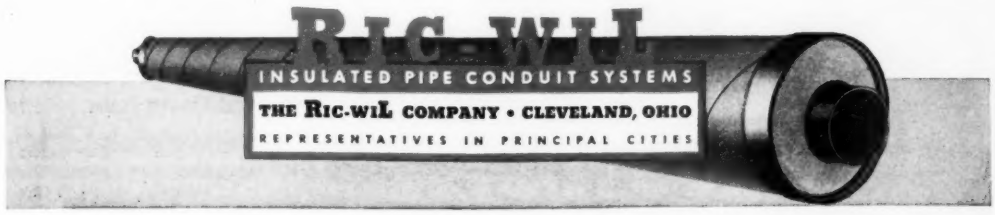
57 separate apartment buildings, ten to fifteen stories high, shopping areas, parks, playgrounds, underground garages—everything needed for modern living by 11,255 families—*without an inch of space used in fuel storage or fuel consumption for comfort heating or service water.*

Instead of fuel this modern city takes delivery of the end product it wants—*heat*—in a form that's most convenient for its needs. It thereby minimizes fire hazards. 650 million pounds of steam, produced at the New York Steam Corporation's East River Power Station, is delivered annually to Stuyvesant Town and Peter Cooper Village.

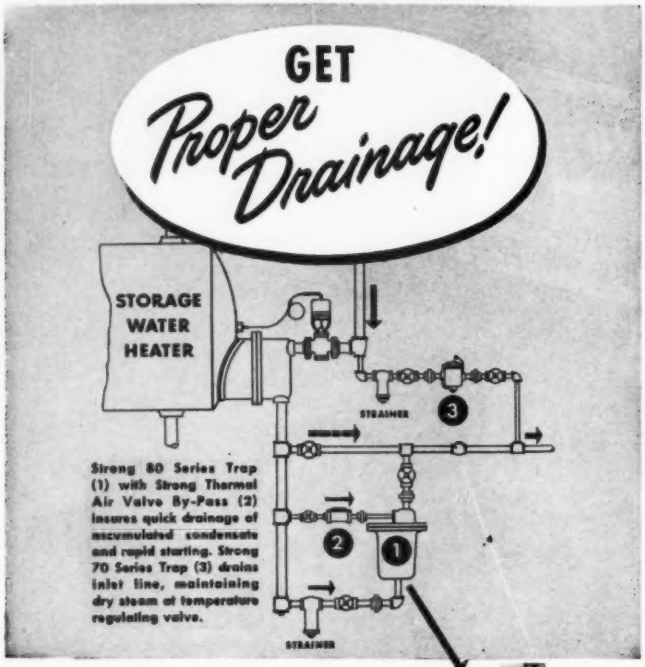
Underground, throughout the area, there's a network of steam lines distributing this heat to every point where it's needed—in quantities and at pressures required. All of this "ready-made heat in its most convenient form" is distributed underground in these communities in Ric-wiL Insulated Piping Units.

Architect: Irwin Clavan, Consulting Engineers: Meyer, Strong and Jones, General Contractor: Starrett Bros. & Eken, Heating Contractor: Baker, Smith & Company.

"Housing America", a Ric-wiL book on mass housing and central heating is free to everyone having a bona fide use for it. Write for Form 4804. Address the Ric-wiL Co., Dept. 59.



styles. *ZE* line comes in five thread sizes, ranging from 10/32 to the fractional size of ⅜-24 in National fine series, with the 8/32 coarse also available in the hex nut. For the *Z*-1200 series, hex nuts come in four thread sizes ranging from 10/32 to the fractional size of ⅜-24, while the anchor nuts are available in 10/32, ¼-28, and 5/16-24. **Elastic Stop Nut Corp of America, 2330 Vauxhall Rd, Union, N. J.**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3
2
1
STRAINER
Strong 80 Series Trap (1) with Strong Thermal Air Valve By-Pass (2) insures quick drainage of accumulated condensate and rapid starting. Strong 70 Series Trap (3) drains inlet line, maintaining dry steam at temperature regulating valve.

PROBLEM: Condensate accumulates in coils due to lack of pressure when thermostatic regulating valve is throttling or closed. *Improper drainage and water hammer result when thermostatic valve opens.*

SOLUTION: *Drain coils fast.* Use trap with four to eight times capacity of actual steam condensate rate. For medium or high pressures, either open or inverted bucket traps are suitable. *Use open bucket traps for low pressures.*

Completeness of the Strong trap line enables our engineers to recommend exactly the type or size you need—open or inverted bucket, closed float, float-and-thermostatic (blast), etc., forged, welded, cast or semi-steel construction. Bring your drainage problems to us for solution. Send for Strong Trap Catalog No. 68 today for complete details of *all* Strong traps.

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Cleveland 13, Ohio

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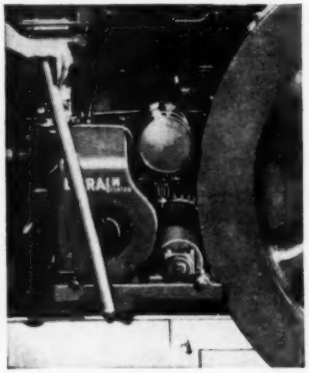

Friction-Drive Starter E72

PRODUCED PRIMARILY for Lorain diesel or gas engine, self-powered friction-drive starter can be used on any horizontal or vertical engine with exposed flywheel. An air-cooled single-cylinder 4-bhp gasoline engine drives a plastic-composition friction pulley through a chain-and-sprocket reduction gearing system. Starter is installed so friction pulley contacts engine-flywheel rim when operator manipulates the throw-in throw-out lever. This brings engine up to speed and starter is disengaged. The 230-lb unit is shipped complete, ready for immediate installation. Over-all dimensions are: length, 18 in.; height, 24 in.; width, 21 in. **White-Roth Machine Corp, Lorain, Ohio.**

Permanent-Magnet Drum E70

SELF-ENERGIZED magnetic drum does not require electric current to produce magnetic field. Powered by Alnico magnets it is adaptable for automatic removal of tramp iron and fine-iron contamination where ma-

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. . . how to get maximum productive energy from our fuel without uselessly heating excess air."

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CITIES SERVICE

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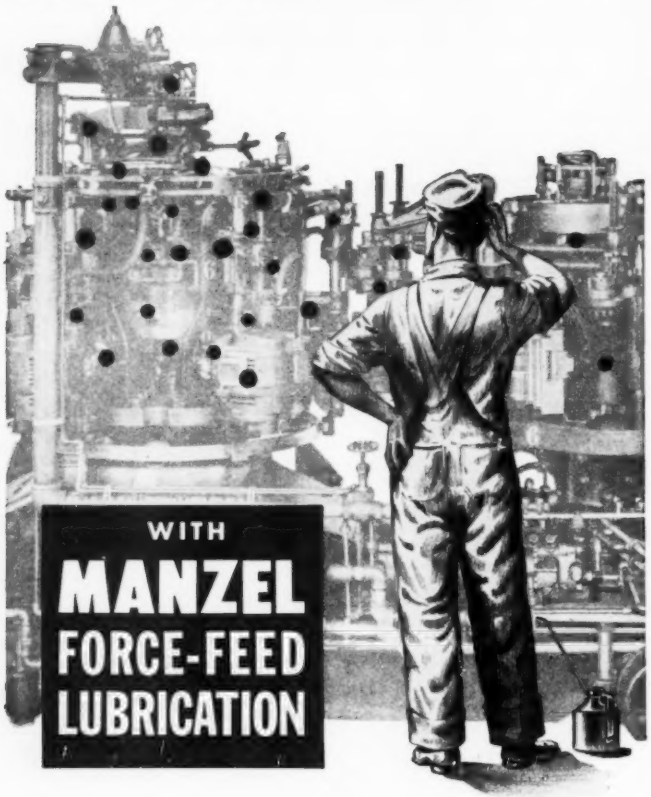

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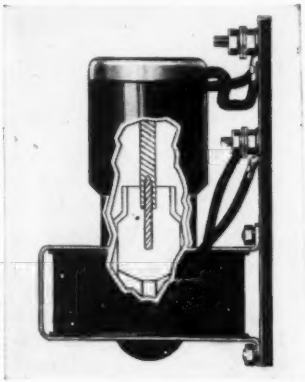
terials are conveyed in spouts, chutes and by similar means not using belts. It can also be used to separate ferrous and nonferrous metals.

Drum separator consists of a revolving cylindrical shell within which a stationary high-powered permanent Alnico magnet is placed. This magnet extends over about one half of the drum's surface. As material is fed on the drum the nonmagnetic portion is discharged first and separately, while the magnetically susceptible portion is held to the drum's shell until it passes out of the magnetic field. Unit is made in 18 different sizes including 12-, 18- and 24-in. diameters and drum widths up to 50 in. Drums can be ordered separately or complete with housing. **Eriez Manufacturing Co, 608 East 12th St, Erie, Pa.**

Terminal Exhaust Snubber E73

SERIES SDT SNUBBERS, available in pipe sizes from 5 to 14 in., inclusive, are for use on all 4-cycle diesel and gas engines with relatively short exhaust systems in stationary and portable service and for 2-cycle otto-cycle gas-engine compressors in the petroleum field. Design combines tail pipe with snubber and is intended for vertical mounting at end of exhaust system. No additional tail pipe is required.

Terminal exhaust snubber gives effective noise control by dissipating the slug's energy before it is released to atmosphere. High restriction is avoided by offering maximum impedance to the high-velocity exhaust slug and minimum restriction to normal exhaust-gas flow. **Burgess-Manning Co, Libertyville, Illinois.**

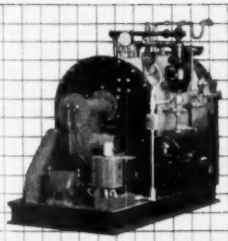


Mercury-Type Relay E87

RELAY CONTACTS are located between two pools of mercury in presence of hydrogen gas under high pressure. Arcing is kept to a minimum while heat and corrosion are virtually eliminated. Units are available with time delay from 0.15 to 20 sec.

Relays are available with normally open or normally closed contacts that have four

LITTLE GEM ▸



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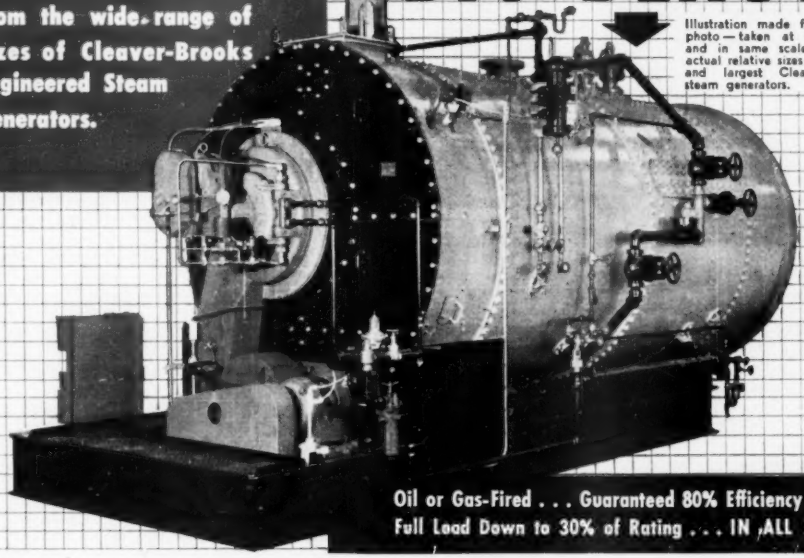
Select to meet your space and steam requirements from the wide range of sizes of Cleaver-Brooks Engineered Steam Generators.

Illustration made from actual photo — taken at same time and in same scale — showing actual relative sizes of smallest and largest Cleaver-Brooks steam generators.



Oil or Gas-Fired . . . Guaranteed 80% Efficiency from Full Load Down to 30% of Rating . . . IN ALL SIZES

WHY search and "shop" for a boiler — install a Cleaver-Brooks engineered and packaged steam generator that fully meets your steam requirements and needs only a minimum of space and headroom.

You can select from a range of sizes 15 to 500 hp. — and you can have your Cleaver-Brooks steam generator equipped for oil, gas, or with a combination burner which permits alternate use of gas or oil and provides for a quick change-over from one fuel to the other.

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Cleaver-Brooks steam generators enable you to burn the available fuel in your area — give you clean, smokeless operation — eliminate fuel and ash handling — need no high or costly stacks — no special foundations — fit under low headroom and into limited space — provide flexible operation to meet fluctuating loads — fully meet all codes.

Available in a size to fit your needs — 15 to 200 p.s.i., 15 to 500 hp. — write for Cleaver-Brooks Steam Generator bulletin.

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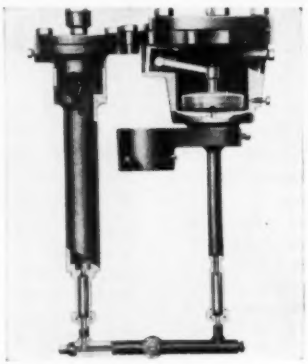
types of action covering method of contact release and closing. Single units are furnished in two sizes, 30 or 60 amp. Relays are suitable for switching of heavy loads in practically all applications, including highly inductive circuits. **Durakool, Inc, Elkhart, Ind.**

Drawout Relay E95

SUITABLE FOR either semi-flush or surface mounting. Form *A* relay can be removed and cover replaced, preventing accidental contact with exposed circuit terminals.

Screws for semi-flush mountings are inserted from back of panel into threaded slotted bosses on mounting flange. Reset button is carried entirely within cover, making positive direct contact with charger reset lever. **General Electric Co, Schenectady 5, N. Y.**



Mercury Manometer E79

MODEL 1500 MERCURY MANOMETER is designed for 1500-psi working pressure and is available in ranges of 10 to 400 in. of water. It is suitable for indicating, recording or controlling instruments. Two manometers can be mounted on a single case for recording two flows or ratio-flow control.

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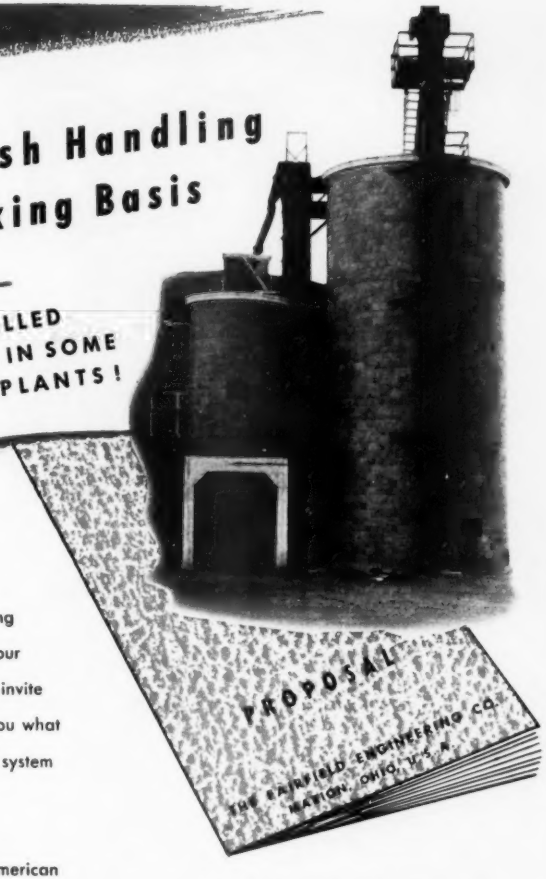

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FOR USE on guide rods, guide posts, reciprocating shafts, these ball bushings support any mechanism that moves or shifts in a straight line. They have low friction, eliminate binding and chatter, give permanent alignment and simplify lubrication. Balls recirculate in race to give unlimited linear travel. Ball bushings are now available for ¾-, ½-, ¾-, and 1-in. shafts. **Thomson Industries, Manhasset, N. Y.**

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AUTOMATIC electronically controlled floating battery charger is suitable for applications requiring accurate floating voltage. Floating charge is maintained within plus-minus 1%, eliminating possibility of over- or under-charging.

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Low-priced valves can be a mighty expensive luxury in the long run, especially in corrosive-fluid pipe lines. Even among valves made of corrosion-resistant alloys, there can be a substantial difference among the life-expectancies of different makes. The "know-how" of the manufacturer makes the difference. For best results, specialization backed up by seasoned experience in design, metallurgy and fabrication of corrosion-resistant alloys, is essential. All of this is included in Aloyco Valves because this Company has concentrated all of its attention on this one type of product throughout its entire business existence. Let us discuss your requirements.

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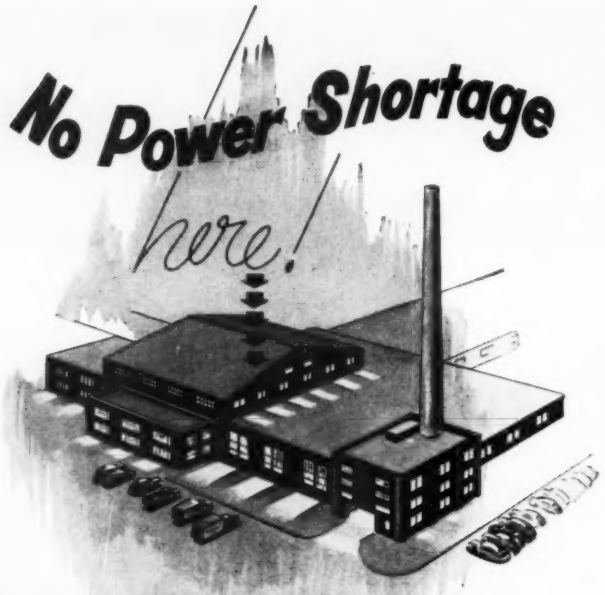

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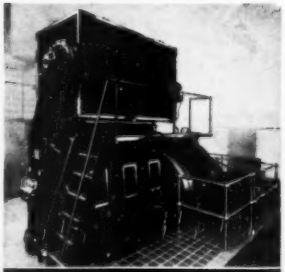

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They generate their *own power* with Skinner "Universal Unaflow" Steam Engines . . . utilizing exhaust steam for heating, processing techniques or other uses . . . and have found that it is more economical than purchasing power or generating with other prime movers.

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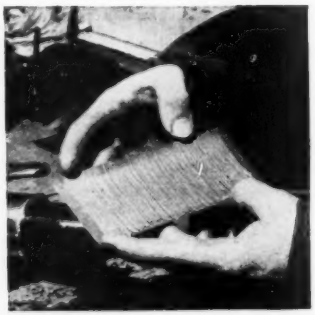
commercial tubes are combined with simple compact controls that have no moving parts or contacts. **Power Equipment Co, Detroit 2, Mich.**

Liquid-Level Control E78

ACRAFLOAT AUTOMATIC liquid level control switch, operated by a free buoyant float encased in a vertical metal pipe, controls and indicates liquid levels to a fraction of an inch, within required vertical differentials of many feet. It may be used to operate pump motors, valves or indicating lights. Manufacturer says it is especially applicable for any operation involving unusual conditions, such as high temperature, high pressure and corrosive, or nonconducting liquids. **Dept A, Clapp Instrument Co, Webster, Mass.**

Intertalk System E93

THIS SYSTEM is applicable to high-noise level areas for paging and receiving answers. It is used to page persons in high-noise level area with the page message reproduced at high volume. To reply, person called presses lever on nearest staff station and carries on normal 2-way conversation on regular voice level. Where necessary, staff station can be located in soundproof booth. **Executone, Inc, 415 Lexington Ave, New York 17, N. Y.**



Recording Chart E81

COATED-METAL RECORDING CHART is designed for meters and recording instruments that are installed to operate under extreme temperature, pressure and other adverse physical conditions. Manufacturer says the chart does not shrink, expand, deteriorate. Neither does it become deformed under atmospheric changes, or by coming in contact with moisture, hydrocarbons, or corrosive elements; nor will the coated surface crack, peel or flake under these conditions. Coated surface is sensitive to very light stylus or dry-pen pressure.

Constant or erratic stylus movements can be recorded in a fine solid line. Chart material, now being manufactured and used in thicknesses of two to three thousandths of an inch, can be made as thin as 15 ten thousandths of an inch. Charts are available in blank face without measurement or division markings. Chart can be made in roll, strip, circular and other shapes. **Otis Pressure Control, Inc, Box 7206, Dallas, Texas.**

How to keep a compressor from losing its breath

TO help compressors to stay on the job with a minimum of maintenance, the Pennsylvania Pump and Compressor Company uses Timken® tapered roller bearings to keep crankshafts running smoothly and dependably.

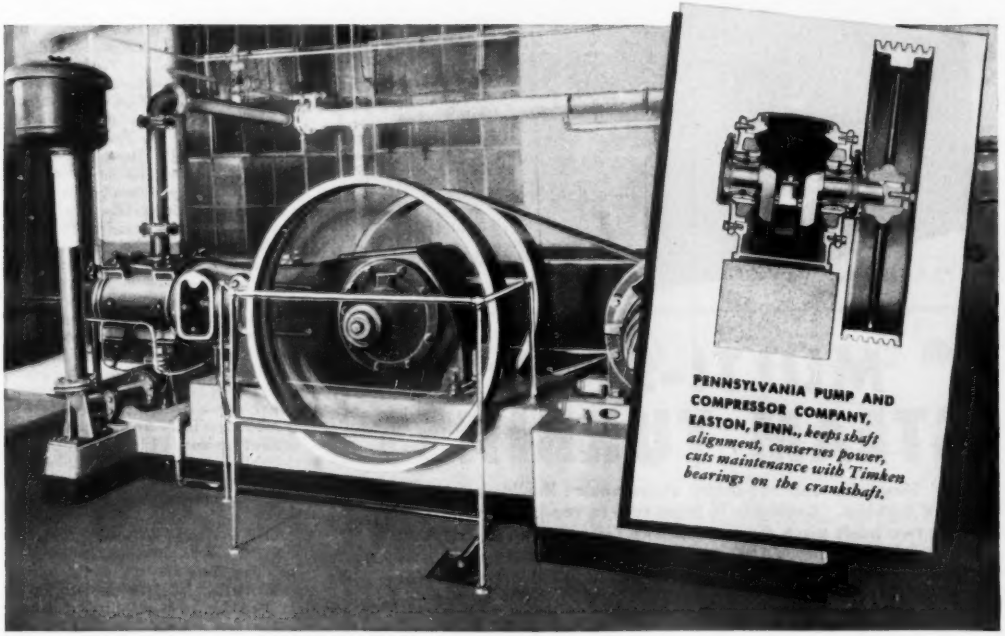
Timken bearings hold the crankshaft in rigid alignment, due to the line contact between rolls and races, and have tremendous load carrying capacity. Because of their tapered construction, Timken bearings can carry any combination of radial and thrust loads.

Under normal usage, Timken bearings last the life of the machine. They permit the use of closures which effectively retain lubricant, saving both maintenance time and material.

Power loss is minimized because Timken bearings have true rolling motion and an incredibly smooth surface finish that enables them to operate freely and without friction.

No other bearings can give your equipment *all* you get from Timken bearings. They're backed by 49 years of bearing research and development. Use them on all the equipment you buy or build, and look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



PENNSYLVANIA PUMP AND COMPRESSOR COMPANY, EASTON, PENN., keeps shaft alignment, conserves power, cuts maintenance with Timken bearings on the crankshaft.

GENERATED UNIT ASSEMBLY

An extra step in the manufacture of Timken bearings—after assembly—results in a natural and true geometric contact being generated between all rotating parts.

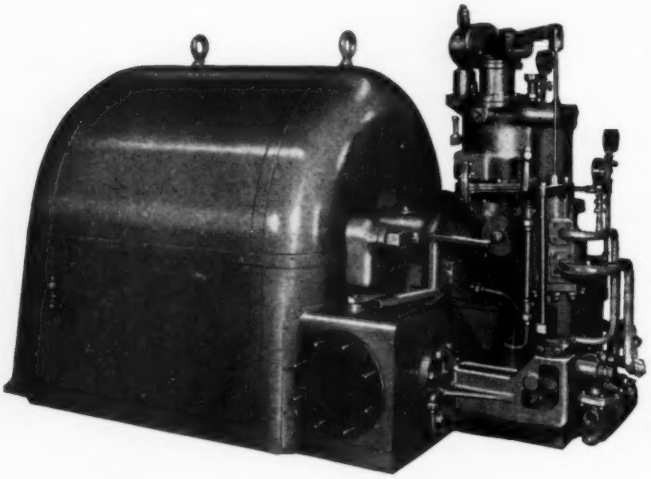
This perfect mating of the component parts—cone, rolls and cup—assures positive roll alignment, long lasting precision, permanent adjustment and smooth operation.

TIMKEN

TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⬯ AND THRUST → ⬯ ← LOADS OR ANY COMBINATION

MURRAY
TYPE UV



MULTI-STAGE STEAM TURBINES

Simplicity and reliability characterize the Murray Type UV Turbine. Available in from two to ten pressure stages on two basic pitch diameters. The Type UV can be supplied in capacities from 100 to 4000 HP, condensing or non-condensing. It can be used for mechanical drives or for smaller generator drives.

Murray Type UV is durably built for dependable performance. Horizontally split case construction to suit operating conditions. Blades are stainless steel, shafts of alloy steel. The assembled rotors are dynamically balanced. Governors are provided to suit specific job requirements.

Let our engineers cooperate in smoothing out your power problems.

WRITE FOR BULLETIN T-122

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

Power News

(*Continued from page 156*)

has been tested by the Bureau at Rifle and has yielded good recoveries of shale oil.

Under cooperative agreements, the Bureau of Mines has also supplied crushed oil shale to Standard Oil Development Co and Union Oil Co of California for experimental processing two continuous-retort pilot plants of their design.

It is anticipated that this joint industry and government research ultimately will result in development of a retort suitable for commercial-scale plants, Boyd stated.

Establishment of two national centers of rocket and jet-propulsion study and research, to be located at Princeton University in the East and California Institute of Technology in the West, has been announced jointly by Harry F Guggenheim, president of Daniel and Florence Guggenheim Foundation, Dr. Harold W Dodds, president of Princeton University, and Dr Lee A DuBridge, president of California Institute of Technology. The new institutions will be known as Daniel and Florence Guggenheim Jet Propulsion Centers. Each will provide facilities for post-graduate education and research in jet propulsion and rocket engineering. They will emphasize particularly development of peacetime uses of rockets and jet propulsion.

Daniel and Florence Guggenheim Foundation has underwritten the two jet-propulsion centers for a period of seven years and has appropriated $500,000 for that purpose. These funds are to be used to pay salaries of professors, stipends of graduate students and similar expenses. Necessary buildings and equipment are to be provided by the universities.

A course on *Special Heat Flow Problems in Industry* will be given at Columbia University, New York City, the coming spring session, starting Jan 31. The lectures by Dr V Paschkis, technical director of heat and mass flow analyzer laboratory, will be on Wednesday evenings from 7 to 9 pm. They are open to men from industry, but carry academic credit also. Registration is from Jan 26-29 and the fee is $50.

Pacific Mills Ltd has now placed a new million-dollar power plant in operation—marking another stage in its extensive post-war development program. New installation includes one of the largest industrial boilers on Canadian Pacific Coast. This unit has an operating pressure of 725 psi at 750 F and steaming capacity of 175,000 lb per hr. Operating with the boiler are two new steam turbine-generators. Largest of these was manufactured in Zurich, Switzerland by Ateliers De Construcion Oerlikon. The second unit of slightly smaller capacity is a General Electric machine.

Reader Service Page for . . .

NEW EQUIPMENT, TECHNICAL LITERATURE

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

NEW PRODUCTS & MATERIALS

See pages 138-142, 148, 178-194

Pressure-Reducing Valve ..... page 138
Gearless Pump ..... page 138
Magnetic Separator ..... page 138
Magnetic Starter ..... page 138
Dual-Fuel Engine ..... page 138
Heat Exchanger ..... page 140
Welding Rod ..... page 140
Turbine-Pumping Unit ..... page 140
Pressure Transmitter ..... page 140
Watthour and Demand Meter ..... page 140
Repair Cement ..... page 140
Chain Vises ..... page 140
Control Valve ..... page 140
Rotary Joint ..... page 140
Demineralizer ..... page 142
Drip-Proof Motor ..... page 142
Miniature Relay ..... page 142
Belt Dressing ..... page 142
Selenium Rectifier ..... page 142
Oil and Gas Burner ..... page 142
Resistance Bulb ..... page 142
Baby Speed Reducer ..... page 142
Smoke Meter ..... page 142
Miniature Tester ..... page 148
Emergency Lighting Unit ..... page 148
Surfacing Powder ..... page 148
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Flux Meter ..... page 180
Air-Fuel Ratio Controller ..... page 180
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Load Regulator ..... page 184
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Friction-Drive Starter ..... page 186
Permanent-Magnet Drum ..... page 186
Terminal Exhaust Snubber ..... page 188
Mercury-Type Relay ..... page 188
Drawout Relay ..... page 190
Mercury Manometer ..... page 190
Linear Ball Bearing ..... page 192
Battery Charger ..... page 192
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Recording Chart ..... page 194

MANUFACTURERS' BULLETINS

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Air Conditioning, Heating, Refrigeration and Ventilating ..... page 196b
Boilers and Auxiliaries ..... page 196b
Controls, Mechanical ..... page 196b
Electrical Equipment ..... page 196b
Maintenance and Safety Equipment ..... page 196b

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

FILL OUT AND MAIL TODAY! NOT GOOD AFTER MAY 1, 1949

Write here number of item in which you are interested

Your Company Name.....

Address.....

.....

Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 2/49

Write here number of item in which you are interested

Your Company Name.....

Address.....

.....

Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 2/49

Write here number of item in which you are interested

Your Company Name.....

Address.....

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 2/49

Write here number of item in which you are interested

Your Company Name.....

Address.....

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 2/49

Write here number of item in which you are interested

Your Company Name.....

Address.....

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 2/49

Write here number of item in which you are interested

Your Company Name.....

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Your Name.....

Your Title.....

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 2/49

Write here number of item in which you are interested

Your Company Name.....

Address.....

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 2/49

Maintenance Materials ..... page 196b
Materials Handling ..... page 198
Mechanical Transmission ..... page 198
Metals and Alloys ..... page 198
Meters and Instruments, Electric ..... page 198
Meters and Instruments, Mechanical ..... page 200
Piping, Fittings, Valves and Specialties ..... page 200
Pumps ..... page 200
Water Treatment ..... page 202
Welding ..... page 202
Other Equipment ..... page 202

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATING

1 **COMMERCIAL AIR CONDITIONERS**—Air Conditioning and Refrigeration Div, Worthington Pump & Machinery Corp, Harrison, N. J. 8-page bulletin No. C-1100-B-33 gives specifications of AHY and AVY Series air conditioning units for commercial and industrial applications.

2 **STEAM HUMIDIFIERS** — Armstrong Machine Works, Three Rivers, Mich. 12-page bulletin No. 1771 describes Armstrong steam humidifiers for automatically controlling relative humidity.

BOILERS AND AUXILIARIES

3 **STEAM BOILER** — Livingstone Engrg Co, 100 Grove St, Worcester 5, Mass. 4-page bulletin No. T-9 gives an operating description of Speedyelectric electrode steam boiler. Bulletin No. 73 discusses Speedyelectric steam-jet cleaner.

4 **AUTOMATIC STEAM GENERATORS** — Dept 18R, Cyclotherm Corp, 90 Broad St, New York 4, N. Y. 6-page bulletin No. P-1 describes construction and operation of Cyclotherm automatic steam generators. Standard ratings and dimensions are included.

5 **HOT STEAM BOILERS** — Alert Engrg Products, 315 W Woodbridge St, Detroit 26, Mich. 6-page bulletin No. 748 discusses specifications of Alert automatic hot steam boilers.

6 **REFRACTORY CEMENT** — Dept M-1, Walsh Refractories Corp, 4070 N First St, St. Louis 7, Mo. Literature, entitled "Here's Where Savings Begin," presents Mort-Airset, a refractory air-setting cement for laying and surfacing firebrick.

CONTROLS, MECHANICAL

7 **GOVERNORS FOR INTERNAL-COMBUSTION ENGINES** — Pierce Governor Co, Anderson, Ind. *Control*, the magazine of power regulation, contains a discussion of governors for all types of internal-combustion engines.

8 **SELF-LUBRICATED GOVERNORS** —Troy Engine & Machine Co, 20 Railroad Ave, Troy, Pa. 4-page bulletin No. 502 describes construction, installation and care of Troy-Engberg Type EN governors for steam engines.

9 **LIQUID - LEVEL CONTROL SWITCH**—Dept. A, Clapp Instrument Co, Webster, Mass. 4-page booklet introduces a new automatic liquid-level control switch, the Acrafloat.

ELECTRICAL EQUIPMENT

10 **FAN-COOLED MOTORS** — Allis-Chalmers Mfg Co, S 70th St, Milwaukee, Wis. 4-page bulletin No. 05B7150 describes nine outstanding features of Allis-Chalmers' totally enclosed fan-cooled motors.

11 **METER SOCKETS**—Anchor Mfg Co, 30 Huntington Ave, Boston, Mass. 4-page catalog shows basic line of Anchor Series 9000 electric meter sockets. A supplementary catalog sheet, Anchor Series 9900, gives a simple, 3-step method of changing from a 4-terminal to a 5- or 6-terminal meter socket.

12 **TUBULAR RHEOSTATS** — James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa. 12-page bulletin No. 41-24 describes various styles of standard, screw-drive, double, graded, switchboard, metal-caged and non-inductive rheostats.

13 **BINDING POSTS**—Superior Electric Co, 425 Hannon Ave, Bristol, Conn. Pamphlet outlines five uses for which the binding posts are adaptable: permanent clamping, spade lug connection, plug-in for banana plugs, looping and clamping, and clip lead.

14 **TRANSFORMERS** — Eisler Engrg Co, 750 S 13th St, Newark 3, N. J. 26-page catalog No. TR-49 covers design and manufacture of transformers from ¼ up to 400 kva and potentials up to 15,000 v, for every class of service.

15 **STORAGE BATTERIES** — Gould Storage Battery Corp, Trenton 7, N. J. 16-page catalog covers stationary batteries for auxiliary control and power. Engineering specifications are included.

16 **SWITCHGEAR AND CONTROL DEVICES**—Allis-Chalmers Mfg Co, S 70th St, Milwaukee, Wis. 16-page bulletin No. 25B7095 describes line of switchgear and control devices. Ratings are given.

MAINTENANCE AND SAFETY EQUIPMENT

17 **OIL CLEANER UNIT** — Bowser, Inc, Fort Wayne, Ind. 4-page bulletin, entitled "The Modern Way to Clean, Stabilize, Dehydrate and Degasify Transformer and Circuit Breaker Oils," presents the Bowser Hydro-Voilfier.

18 **AIR TOOLS**—Buckeye Tools Corp, Dayton 1, Ohio. Chart gives informative data on air power development and air tool efficiency.

MAINTENANCE MATERIALS

19 **IRON CEMENT** — Dept PW, Smooth-On Mfg Co, 570 Communipaw Ave, Jersey City 4, N. J. Folder tells how to make bell-and-spigot joints with Smooth-On No. 5 iron cement.

FIRST CLASS
PERMIT No. 64
(Sec. 510, P.L. & R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c. Postage Will Be Paid by—

POWER

330 West 42nd Street

New York 18, N. Y.

FIRST CLASS
PERMIT No. 64
(Sec. 510, P.L. & R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c. Postage Will Be Paid by—

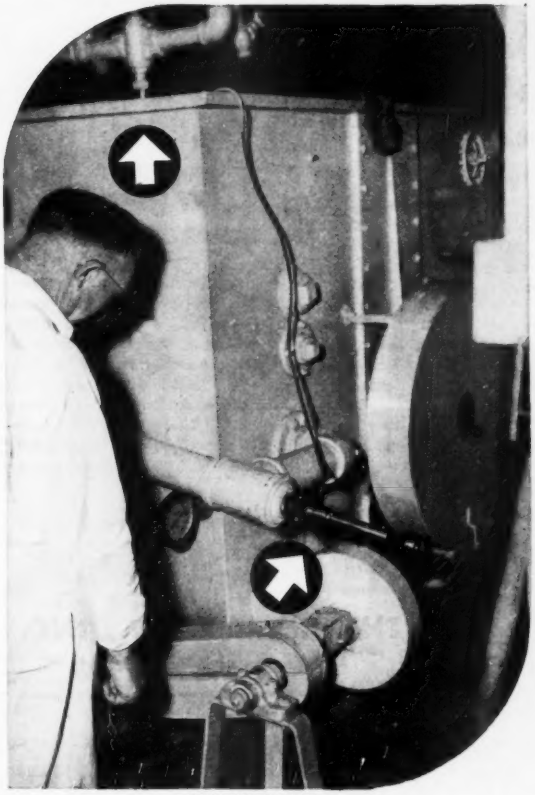
POWER

330 West 42nd Street

New York 18, N. Y.

HOW SARCO SAVES WATER

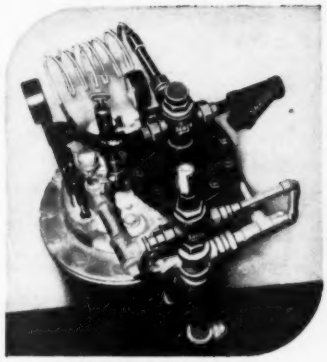
This can cooler handles 40 No. 10 tins of chocolate and cooked foods per minute. The water temperature must never exceed sixty degrees, but the load and the incoming water temperatures vary. The simple hook-up of a Sarco TR-21 regulator holds the tank water within the required limits, day after day, without supervision. The water saving alone paid for the change in a few months and can cooling is now automatically uniform.



CAN COOLING

Each oil cooling system on a battery of plastic presses required a full stream of city water—a six inch pipe running wild at $500 a month for the plant. Sarco Control reduced the stream to a trickle and the entire battery and all air compressors are being Sarco equipped with a total saving estimated at $300 a month. Ask for Catalog No. 700.

You also can save hot water with Sarco by having temperatures correct at all times. The Instantaneous Water Heater shown at the right has two Sarco Controls, one for the hot water and one for blended water. Catalog No. 600.



WATER HEATER

230

SARCO
SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

The PACKING for LONG SERVICE

ALLPAX

ALLPAX is the packing that won't let you down when temperatures go up or when you are looking for long, care-free service from your equipment. One of the reasons for the long-wearing service of ALLPAX is that it remains perfectly dry while holding its lubricant regardless of pressure or temperature. Its long asbestos fibres prevent the molded ALLPAX from amalgamating into a dense metallic mass, but keep it bonded together in a resilient packing that retains its springiness even after long service. This resiliency makes ALLPAX leak-proof without excessive pressure. The lubricant in ALLPAX cannot be forced out regardless of pressure, and a perfect film is maintained between packing and shaft at all times.

Try ALLPAX and prove its advantages in long service.

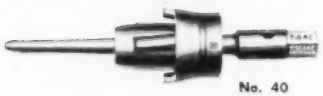
ALLPAX distributors are all around you. Get in touch with yours and ask him to supply your requirements.

THE ALLPAX CO., INC.

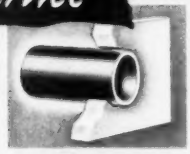
MAMARONECK, NEW YORK

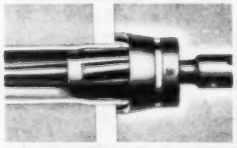
Wiedeke

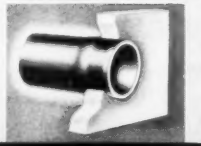
TUBE EXPANDERS NATIONALLY KNOWN FOR DEPENDABLE . . . ECONOMICAL Service



No. 40







IDEAL ACE TUBE EXPANDERS

The boilermakers' selection for more than a half century, for LOCOMOTIVE and general boiler work . . . guard straddles tube and bears against tube sheet, suitable for rolling new tubes and re-rolling tubes with flared or beaded ends.

MINIMUM FRICTION . . . absorbed by bronze bearing between guard and frame, resulting in much easier and faster operation.

Long rolls have generous radius on end and will not create sharp offset within the tube.

See your dealer or write today for general catalog on Wiedeke Tube Expanders and Tube Cutters.

The Gustav Wiedeke Company

DAYTON 1, OHIO

20 CONCRETE FOR FLOORS—Lumnite Div, Universal Atlas Cement Co, 135 E 42nd St, New York 17, N. Y. 16-page booklet gives specifications and methods of application of Lumnite cement for floors.

21 POWER-PLANT CLEANING — Oakite Products, Inc, 123 Thames St, New York 6, N. Y. 18-page service digest discusses improved methods that expedite degreasing, descaling, cleaning and related tasks in power-plants.

22 RING PACKING — Greene, Tweed & Co, North Wales, Pa. 12-page bulletin No. TB-918 on the Palmetto G-T ring packing includes diagrams on principles, piston and rod seal assembly, dimension tables, etc.

23 PROTECTIVE SURFACING MATERIAL—Dampney Co of America, Hyde Park, Boston 36, Mass. 8-page bulletin No. 1530 describes Apexior No. 1, the protective surfacing material for boilers and for power and processing equipment in similar wet-heat service.

MATERIALS HANDLING

24 FREIGHT ELEVATORS AND CAR SEATS — Otis Elevator Co, 260 Eleventh Ave, New York 1, N. Y. Bulletin No. B-717 (8440) shows a typical installation of an Otis freight elevator. Bulletin No. B-515 (8490) discusses the Otis folding car seat for elevator attendants.

25 DRY-MATERIAL CONVEYOR — Fuller Co, Fuller Bldg, Catasauqua, Pa. 12-page bulletin No. F-H-1, entitled "F-H Airslide," describes a conveyor for handling of fine, dry materials.

26 ALNICO MAGNETS—Dings Magnetic Separator Co, 4740 W McGeogh Ave, Milwaukee 14, Wis. Bulletin No. B-1205A discusses Dings high-intensity Perma-Plate Alnico magnets for removal of harmful tramp iron from chemicals, coal, foundry sand and other materials.

27 CONVEYOR METER — Builders-Providence, Inc, 14 Codding St, Providence, R. I. 16-page bulletin No. E4-550 covers the new Conveyoflo meter for continuously weighing and totalizing flow of dry materials.

28 SEPARATION MAGNETS — Ohio Electric Mfg Co, 5900 Maurice Ave, Cleveland 4, Ohio. 4-page bulletin No. F-2001 gives informative data on application, construction, selection and suspension of Ohio separation and road sweeping magnets.

MECHANICAL TRANSMISSION

29 BALL BEARING — Norma-Hoffmann Bearings Corp, Stamford, Conn. 24-page booklet presents the Cartridge ball bearing.

30 FLUID DRIVES—American Blower Corp, P O Box 58, Roosevelt Park Annex, Detroit 32, Mich. Bulletin No. 6919 presents American Blower fluid drives for smooth transmission of power and stepless variable-speed control.

METALS AND ALLOYS

31 PHOSPHOR BRONZE — Phosphor Bronze Corp, 2200 Washington Ave, Philadelphia 46, Pa. 28-page technical data booklet covers phosphor bronze strip and sheet, wire, rod, rope, castings, bushings and ingots.

32 FLUORINE CORROSION — International Nickel Co, 67 Wall St, New York 5, N. Y. 4-page technical report discusses high-temperature attack on metals by fluorine and by hydrogen fluoride and on the resistance of nickel, monel and other materials to these corrosive agents at various temperatures.

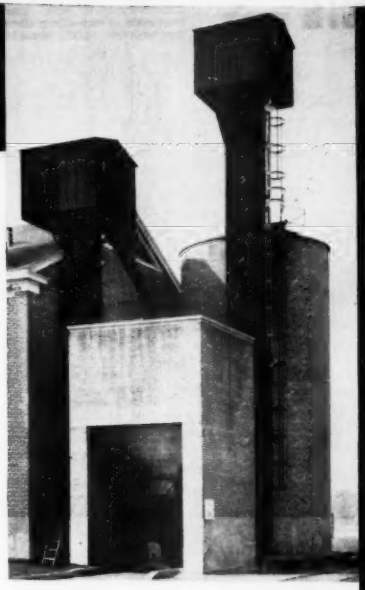
METERS AND INSTRUMENTS, ELECTRIC

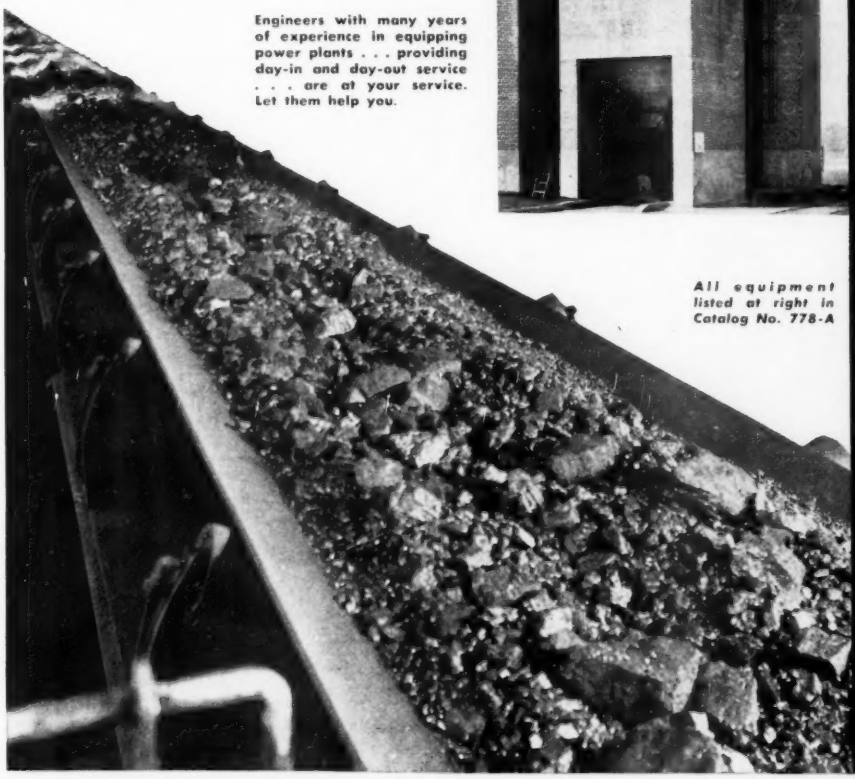
33 THERMOCOUPLES AND PYROMETERS — Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill. 40-page bulletin No. T/C7 provides in-

Dependability
— First Consideration

Coal and ashes handling machinery must be right. Failure especially during peak-load periods can be just as disastrous as the failure of the power generating equipment. Besides giving remarkably low cost per ton of coal handled, Jeffrey equipment has been safeguarding many plants for years. There is an efficient system for every type and size of plant.

Engineers with many years of experience in equipping power plants . . . providing day-in and day-out service . . . are at your service. Let them help you.





All equipment listed at right in Catalog No. 778-A

- Apron Feeders
- Ashes Handling Systems
- Bin Valves
- Belt Conveyors
- Belt Idlers
- Bucket Elevators
- Chains
- Car Pullers
- Crushers
- Drag Chain Conveyors
- Drive Arrangements
- Pivoted Bucket Conveyors
- Silo Storage Systems
- Skip Hoists
- Scraper Conveyors
- Sprockets
- Transmission Machinery
- Track Hoppers
- Weigh Larries
- V-Bucket Conveyors

THE JEFFREY MANUFACTURING COMPANY

Established 1877

932 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 2, Birmingham 3, Boston 16, Buffalo 2, Chicago 1, Cincinnati 2, Cleveland 13, Denver 2, Detroit 13, Harlan, Houston 5, Huntington 19, Jacksonville 5, Milwaukee 2, New York 7, Philadelphia 3, Pittsburgh 22, St. Louis 1, Salt Lake City 1, Scranton 3

For **STRENGTH** specify

TRI-LOK

RECTANGULAR

OPEN STEEL FLOORING

The locked-in strength of Tri-Lok enables it to stand up under heavy loads—even on long spans. No rivets, bolts, or welds are used in the construction of Tri-Lok; this feature eliminates the possibility of loose joints.

Tri-Lok is also available in Diagonal, or Super-Safety U-type Flooring, and in Stair Treads of all types. Write for Bulletin KM 1140.

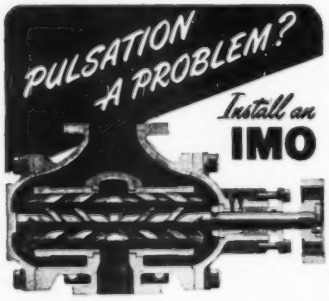
DRAVO CORPORATION

National Distributor for the Tri-Lok Company

Dravo Bldg., Pittsburgh 22, Pa.

Sales Representatives in Principal Cities

DRAVO



With an IMO Pump delivery is not interrupted by the periodic strokes of a piston or the opening and closing of valves and ports. The turning of the rotors in an IMO forces the fluid from suction to discharge in a continuous, uniform flow.

IMO pumps can be furnished for practically any capacity and pressure required for oil, hydraulic-control fluids, other liquids.

Send for Bulletin 1-145P

IMO PUMP DIVISION of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

formation on selection of proper thermocouples and protecting tubes, methods of checking thermocouples and pyrometers, and installation data.

34 INSULATION TESTERS—Herman H Sticht Co, 27 Park Pl, New York 7, N. Y. 4-page bulletin No. 1248 shows, in condensed form, all Megohmer insulation and resistance testers sold by the company.

35 VIBRATION TESTERS—General Electric Co, Schenectady 5, N. Y. Bulletin No. GEC-393 presents the GE gas-turbine vibration meter for measurement of vibration displacement, velocity and acceleration.

36 INSULATION TESTERS—James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa. 24-page bulletin No. 21-20-24 describes Megger heavy-duty insulation resistance testers.

METERS AND INSTRUMENTS, MECHANICAL

37 INSTRUMENT SELECTION—Taylor Instrument Companies, P O Box 110, Rochester 1, N. Y. Bulletin No. 98170, entitled "Taylor Guide for Correct Instrument Selection," gives a comprehensive bird's-eye view of the Taylor line of temperature, pressure, humidity, flow and liquid-level instruments.

38 TEMPERATURE INSTRUMENTS—Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa. 34-page catalog No. ND4-33-461 describes instruments for measuring temperature of generators, motors, condensers, transformers, etc.

PIPING, FITTINGS, VALVES AND SPECIALTIES

39 METAL TUBING—Pennsylvania Flexible Metallic Tubing Co, 7200 Powers Lane, Philadelphia 42, Pa. Booklet presents proper application of metal tubing for exhaust and fuel lines.

40 INDUSTRIAL VALVES—Parker Appliance Co, 17325 Euclid Ave, Cleveland 12, Ohio, 48-page catalog No. 301 discusses globe and needle valves, check valves, relief valves, plug valves, valve accessories.

41 VALVES AND SPECIALTIES—Worthington Pump and Machinery Corp, Harrison, N. J. 6-page bulletin No. W-350-B5B describes flanged gate and needle valves, hose nipples, bars, welding electrodes and screw machine products.

42 SAFETY RELIEF VALVES—Marine & Industrial Products Co, 1524 Vine St, Philadelphia 2, Pa. 24-page catalog No. 80 covers safety relief valves for protection of boilers, compressors, heat exchangers, kettles, pressure piping, pressure vessels, process equipment and regulators.

43 PRESSURE - SEAL BONNET VALVES—Edward Valves, Inc, East Chicago, Ind. 8-page catalog section No. 12-H presents all types of Edward cast-steel pressure-seal bonnet valves.

44 STEAM TRAPS—Armstrong Machine Works, Three Rivers, Mich. 8-page bulletin explains how to select steam traps for unit heaters by the Btu rating method and condensate weight method.

PUMPS

45 BOILER FEED PUMPS—Worthington Pump and Machinery Corp, Harrison, N. J. 12-page bulletin No. W-319-B1C discusses Type WC high-pressure centrifugal boiler feed pumps.

46 CENTRIFUGAL PUMPS—Goulds Pumps, Inc, Seneca Falls, N. Y. 8-page bulletin No. 622-A-2 presents new centrifugal pumps for clear liquids, general water supply, circulating, transfer service, air conditioning, irrigation and similar applications.

New Process Uses

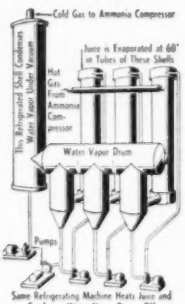
FRICK

Refrigeration

for both Boiling and Freezing Orange Juice!

The plant of the Florida Citrus Canners Cooperative, now in operation at Lake Wales, is remarkable because it uses refrigeration instead of steam for concentrating fruit juices.

The cycle shown, on which Mojonnier Bros. Co. of Chicago have patent applications, utilizes both the heat and the cold supplied by a refrigerating machine — and with excellent economy.

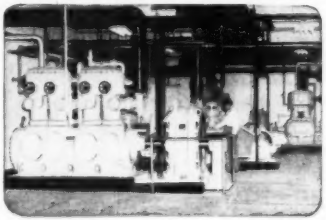

Cold Gas to Ammonia Compressor
Juice is Evaporated at 60° in Tubes of These Shells
Hot Gas From Ammonia Compressor
Thru Refrigerated Shell Condenser
Water Vapor Under Vacuum
Water Vapor Drum
Pumps
Same Refrigerating Machine Heats Juice and Condenses Water Vapor Driven Off

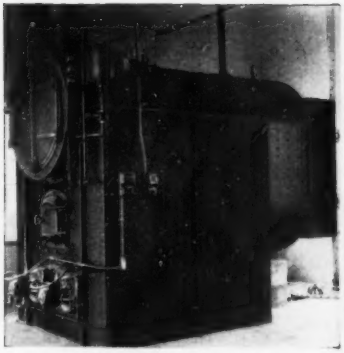
A separate Frick refrigerating system quick - freezes and stores the vacuum-packed juices at ten below zero. Food value and fresh flavor are both retained. Additional Frick machinery to enlarge the plant has recently been purchased.

Let us cooperate in solving your particular refrigerating problems.

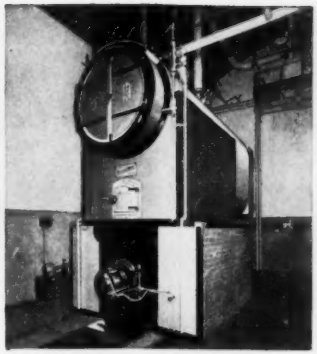
DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO PENNA. U.S.A.

4 of 5 Frick Ammonia Compressors, Lake Wales

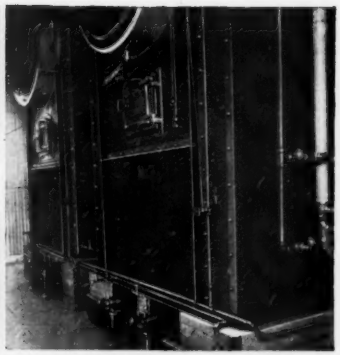




● 80 HP. ECONOMIC with extended sides providing furnace volume for oil firing.



● 150 HP. ECONOMIC with brick base built-up in the field to provide furnace volume for oil firing.

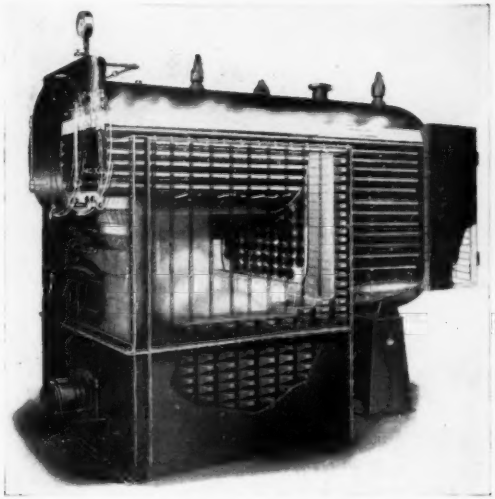


● 2-150 HP. ECONOMICS with extended sides providing furnace volume for oil firing.

For OIL or GAS Firing

THE ECONOMIC BOILER

HUNDREDS of Economics—the boiler refractory lined furnace combination, are gas or oil fired. The furnace volume required with these fuels is provided either by building a brick base in the field, by increasing boiler height (watch railroad clearances) or by the use of the new Erie City Steel Base completely shop fabricated with 13 1/2" refractory lining. This last method eliminates costly brickwork in the field and permits shipment of any standard size of Economic to 300 hp. as one unit and base as a separate unit. This economical steel base can be furnished in heights from 2 to 6 feet and provides a sturdy long life foundation that becomes an efficient addition to furnace volume.



● ERIE CITY'S NEW HIGH REFRACTORY LINED BASE eliminates costly brickwork in the field, speeds the erection of the boiler, and provides the extra furnace volume required for oil, gas, or stoker firing.

The refractory lining of the steel base is the same as used in the well known Economic. It consists of 9" of first grade refractory and 4½" of block insulation or 13½" of refractory depending upon conditions. The weight of the boiler rests on the steel base not on the refractory.

COMPLETE STEAM POWER PLANT EQUIPMENT

ERIE CITY

Complete Steam Generators ● Type C 3-Drum Boilers ● Type VL 2-Drum Boilers ● The "Economic" Boiler with or without Water Walls ● Welded H. R. T. Boilers ● Welded Steel Heating Boilers ● Coal Pulverizers ● Underfeed Stokers ● Welded Pressure Vessels for the Process Industries.

ERIE CITY IRON WORKS • ERIE, PA. • *Since 1840*

No other cleaner could do it!

★ The engineer of an upstate New York university power plant with five large boilers tried every known make of tube cleaner, including our old Roto. He didn't think any of them "worth a hoot" for removing his rock-like scale.

★ When we developed the new ROTOJET, we sent him our Model 525 for field test. He was so amazed and tickled with the way this powerful new cleaner performed that he insisted on buying it. He said it was the first cleaner that ever cleaned his tubes properly, and that "it made a tough job seem ridiculously easy."

★ No tube cleaner built during our 38 years of specialization in this field can even remotely compare with the new ROTOJET for power, efficiency, and cleaning speed. A single cleaning job with a ROTOJET will prove that you can't afford to use any other tube cleaner.

Send for new bulletin.

ELLIOTT COMPANY-ROTO DIVISION

153 Sussex Avenue **Newark 1, N. J.**

WATER TREATMENT

47 FOAM PREVENTION — Power Chemicals Div, E F Drew & Co, 15 E 26th St, New York 10, N. Y. Bulletin No. 8/5/48RCU presents Drew Antifoam-8, a product that is said to eliminate and prevent foaming in boiler operations.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **WATER CONDITIONING** — Liquid Conditioning Corp, 114 East Price St, Linden, N. J. 8-page brochure outlines background, facilities, and processes and equipment offered by the company in fields of water treatment and conditioning of other liquids. The brochure also contains illustrations showing plant facilities and installations of various types of Liquon equipment.

48 DE-IONIZING SYSTEMS — Dearborn Chemical Co, 310 S Michigan Ave, Chicago 4, Ill. 20-page bulletin No. 5005 provides information on production of mineral-free water for diesel cooling systems, steam generators, chemical process industries, etc.

WELDING

49 WELDED DESIGN—James F Lincoln Arc Welding Foundation, Cleveland 1, Ohio, 16-page reprint, entitled "Design for Welding," gives examples of how cost may be reduced and quality improved through proper welded design.

50 ARC WELDING—Dept 2328, Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. 16-page reprint, entitled "How to Use Helium Shielded Arc Welding," by H O Jones, covers such topics pertinent to inert-gas, shielded-arc welding as basic features, welding currents, electrodes and gasses, scope of the process, equipment employed, process procedures and histories on specific applications of Heliwelding.

51 WELDING PRODUCTS — Tweco Products Co, P O Box 666, Wichita, Kan. 12-page Twecolog, Form No. 7, shows complete line of Twecotong and Hol-Grip electrode holders, Redhead ground clamps, cable connectors, terminal connectors, cable splices, Twecolugs and carbon electrode holders.

52 COMBINATION ARC WELDERS AND GENERATORS — Hobart Brothers Co, Hobart Sq, Troy, Ohio. 4-page folder describes new Hobart 300-amp arc welders and power generators combined.

OTHER EQUIPMENT

53 SILICONE FLUIDS—Dow Corning Corp, Midland, Mich. 30-page booklet, Fluid Series No. 3, gives properties and behavior of the DC 200 silicone fluids.

54 PLANT DESIGNS — Lockwood Greene Engineers, Inc, 10 Rockefeller Pl, New York 20, N. Y. 6-page booklet shows new plants and extensions designed by Lockwood Greene Engineers.

55 CATHODIC PROTECTION — Aluminum Co of America, 230 Park Ave, New York 17, N. Y. 8-page brochure describes types of corrosion that anodes will combat and illustrates varieties of magnesium anodes that are available from Alcoa.

56 TUBULAR HEAT EXCHANGERS —Griscom-Russell Co, 285 Madison Ave, New York 17, N. Y. 32-page bulletin No. 916 discusses present designs of G-R tubular heaters, coolers, condensers and heat exchangers.

FAIRBANKS-MORSE

motorgear

Simplify your slow speed DRIVES

The new Fairbanks-Morse Motorgear which combines double reduction, helical gears with the well-known Axial Air Gap Motor *is a complete slow speed unit — more compact than the average electric motor alone!* Wherever you are using a slow-speed drive in standard ratios up to and including 10 h.p., the Motorgear will save space and weight, minimize servicing and improve the appearance of the driven unit. Send for a Motorgear bulletin. Fairbanks, Morse. & Co., Chicago 5, Illinois.

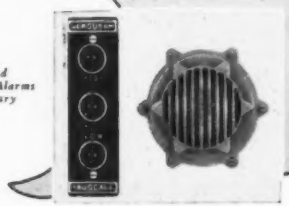
FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS • GENERATORS
STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS

This New Distance Reading Jerguson Liquid Level Gage Handles Pressures to 2500 lbs.!

JERGUSON TRUSCALE GAGE



Visible and Audible Alarms at Auxiliary Points

HERE is a sensational new gage . . . the Jerguson Truscale . . . that gives you important new features for distance reading of liquid level in boilers, deaerating tanks, etc. It is also equipped with foolproof anti-surge mechanisms for use on boats.

Sensitive And Accurate: The construction of the Truscale gives it exceptional sensitivity to water level changes. It is capable of registering change in the head of water with accuracy of ½ of 1% of scale reading. **New Alarm System:** The gage may be equipped with a positive alarm system whereby lights flash simultaneously with the sound of signal horns at key points in your plant if level falls dangerously low or rises too high.

Adjustable for 0 to 2500 lbs. W.S.P. Dial scale is illuminated. Low, Normal, and High markings as well as the pointer are phosphorescent so that they may be read in the dark in case of power interruption. It will pay you to investigate this top efficiency gage with the *extra* features.

You Will Benefit From These Special Truscale Features

Horn and Light Alarms May be Installed at Many Auxiliary Points

Featherlight Pointer System

Illuminated Dial of Translucent Plastic

New Positive Magnetic Principle

Available for Panel, Pedestal or Wall Mounting

Write for Truscale Data Unit.

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY

100 Fellsway • Somerville 45, Mass.

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Robert H Morse Jr, vice-president in charge of all operations, Fairbanks, Morse & Co, has been elected president and treasurer of Diesel Engine Manufacturers Assn at its annual meeting, held in Chicago, Dec 8. A W McKinney, executive vice-president of National Supply Co, and O H Fischer, president of Union Diesel Engine Co, have been made vice-presidents of DEMA. Harvey T Hill has been reappointed executive director.

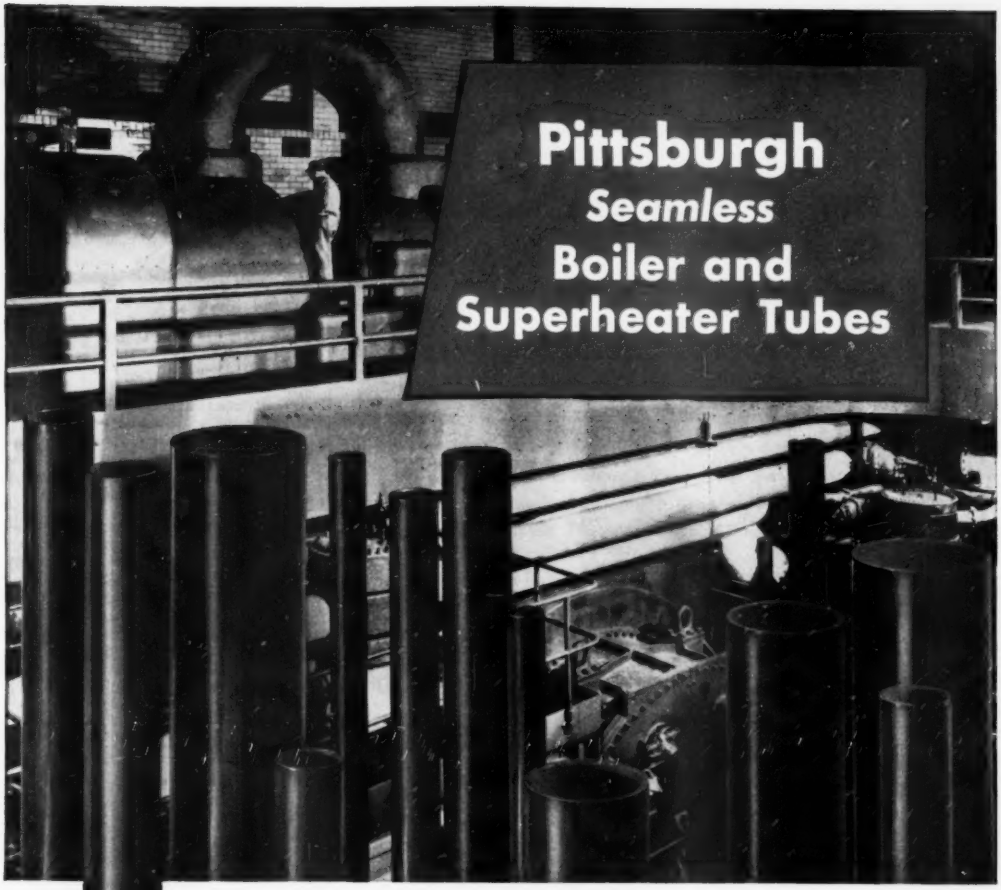
Directors elected were George W Codrington, vice-president of General Motors Corp and general manager of Cleveland Diesel Engine Div; Perry T Egbert, vice-president in charge of diesel and locomotive sales, American Locomotive Co; Robert E Friend, president of Nordberg Mfg Co; Gordon Lefebvre, president of Cooper-Bessemer Corp; Walter A Rentschler, vice-president of Lima-Hamilton Corp; E J Schwanhausser, vice-president in charge of sales, Worthington Pump & Machinery Corp; Marvin W Smith, executive vice-president of Baldwin Locomotive Works; Morse, McKinney and Fischer.

United States Rubber Co has announced increases from 5 to 10% in prices of electrical wire and cable to offset the rising costs of labor and materials. The increases became effective Nov 1. Prices for copper and aluminum building wire, service entrance cable and nonmetallic sheathed cable have been raised 5%, while prices for lead-encased cables have been raised 10%, C W Higbee, manager of wire and cable dept, said. Copper and aluminum building wire, used to wire homes and industrial buildings, represent the largest volume lines.

James F McNamara, vice-president of International Nickel Co. announces that as a result of continued research and experiments with wartime equipment, it is now possible to produce seamless tubes and pipes in sizes more than double those available before the war. McNamara said that 4000-ton extrusion press, installed at Inco's Huntington Works during the war and used largely for production of rotating shell bands, is now producing pipe in nickel, monel and other high nickel alloys in diameters up to 9¼ in. and lengths up to 12 ft.

"These shapes can be further cold drawn into seamless pipe 8 in. in dia, wall thicknesses up to ¾ in., and in varying lengths," he said.

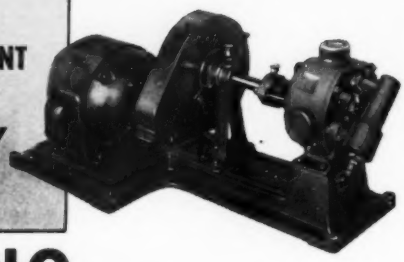
Utah Power and Light Co has authorized purchase of a 26-acre tract at Pueblo and North Temple Streets in Salt Lake City as a site for an $11,000,000 steam-electric generating plant. The site adjoins the present UP&L Jordan plant. Planned as a 63,000-kw plant, it is to be the largest single generating unit in the company system. According to President George M Gadsby, its design will permit expansion to 200,000 kw in the future. Preliminary construction is to begin in 1949, with power production scheduled in September 1951. The plant will utilize pulverized coal fuel and will feature hydrogen-cooled generators and turbines of the most efficient design. The unit's boilers, which will operate at 1400 psig, will be capable of an output of 620,000 lb of steam per hr.



Many operators find the long service and ease of installation of Pittsburgh Seamless Boiler Tubes give them *extra* economy in their boiler and superheater units. The carefully controlled chemical and physical properties and the wall strength inherent with seamless tubes give you trouble-free installation and long satisfactory service. Pittsburgh Seamless Boiler Tubes are produced in carbon and alloy grades. Pittsburgh Steel Company, 3270 Grant Building, Pittsburgh 30, Pa.

Pittsburgh Steel Company

MORE OF THE THINGS YOU WANT in a ROTARY PUMP



VIKING...

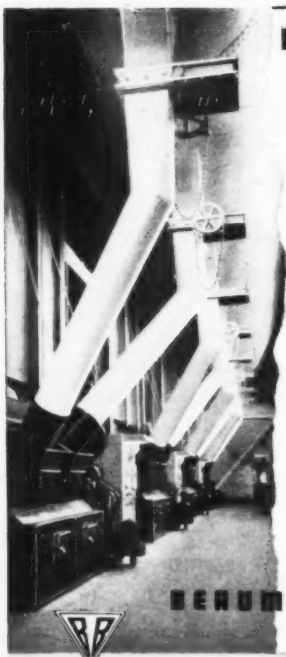
Gives You These Features:

1. Self priming — Steady and even discharge.
2. Proved simplicity — Only 2 moving parts . . . a "gear within a gear".
3. Slow speed — Long, dependable service.
4. Built to handle the liquid being pumped — No compromise construction.
5. Complete control of manufacture — From factory-owned and operated foundries to final assembly.

Send for bulletin 47SW—It will be sent promptly.

See Our Catalog In SWEETS

Viking Pump Company
Cedar Falls, Iowa



FOLLOW THE *Leader*

. . . and INSTALL BEAUMONT ANTI-FRICTION GATES

● Many utilities are replacing their present gates with Beaumont improved anti-friction type gates. Since the first order from one utility in 1942, many repeat orders have been received for installation in this company's other power plants.

In all cases, these gates have given very satisfactory service. According to one user, "No trouble whatever has been experienced opening and closing these gates—and no maintenance has been necessary other than periodic greasing".

Many leading plants throughout the country are finding it economical and time-saving to install Beaumont trouble-free type gates such as those pictured at left. Follow the leaders and do the same. These gates are made in sizes from 14" to 30". Request complete information.

One contract—one responsibility

BEAUMONT BIRCH *Company*

1502 RACE STREET • PHILADELPHIA 2, PA.

Designers *Manufacturers* *Erectors* COAL AND ASH HANDLING SYSTEMS

A Corliss engine, which has served in the power plant of National Cash Register Co, Dayton, Ohio, since the turn of the century, is about to take its rightful place in a special Hall of Fame. Old "No. 1561" as it is known in the plant, will be on display in its retirement alongside an airplane flown by the Wright Brothers, a wooden grist mill driven by a waterwheel, a Conostoga wagon, a Concord coach, a couple of ancient railway locomotives, a covered bridge and a restored canal lock.

The special Hall of Fame that it will occupy is in a park in Dayton near the National Cash Register plant—a gift to the city by Col E A Deeds, that company's chairman of the board. The Corliss engine was built by C & G Cooper Co, of Mt. Vernon, Ohio, which is now the Cooper-Bessemer Corp. The original drawings and blueprints for the old Corliss are still intact in Cooper-Bessemer vaults. Although the present company gets occasional repair orders for Corliss engines that are still in service, its current products consist of diesel engines, natural gas engines, compressors and liquid pump.

Industrial users of arc welding will be interested in four specifications for arc-welding electrodes recently completed by committee on filler metal, jointly sponsored by American Welding Society and American Society for Testing Materials. Tentative specifications are (1) mild-steel arc-welding electrodes (2) low-alloy steel arc-welding electrodes (3) corrosion-resisting chromium and chromium-nickel-steel welding electrodes (4) copper and copper-alloy metal-arc welding electrodes. Individual copies of all the above specifications are available from either the *American Welding Society,* 33 *W 39th St, New York* 18, *N. Y.,* or *American Society for Testing Materials,* 1916 *Race St, Philadelphia* 3, *Pa., at* 25¢ each.

American Standards Assn has announced a new publication in the series of standard letter symbols for technical and scientific writing. All common terms in elementary physics and some in advanced physics and related fields are included. Most symbols in mathematics, crystallography, meteorology, X-rays, statistics, etc, have been omitted. American Standard Letter Symbols for Physics, Z10.6-1948, may be obtained from American Standards Assn, 70 E 45th St, New York 17, N. Y., for $1.00 per copy.

Vannevar Bush, retiring president of the Research and Development Board of the National Military Establishment, has been chosen to receive the 1949 Industrial Research Institute medal awarded for outstanding contributions to field of industrial research. The Institute, composed of 106 companies representing diversified types of industry throughout the nation, cited Dr Bush for his inspired leadership in the office of scientific research and development, in marshaling industrial and academic research and coordinating it with military effort in the common defense, thus developing an instrument of government so effective as to provide a pattern for continued service. The medal will be presented Feb 3 during the winter meeting of the Institute, at Rye, N. Y.

Satisfactory service for over 35 years on a

Tough Assignment, too!

Golden-Anderson

non-return VALVES

In thousands of tough applications Golden-Anderson Non-Return Valves are protecting life and property by automatically performing these three vital functions:

(1) Cut in boiler when pressure equals line-header pressure.

(2) Isolate boiler when pressure is lower than line-header pressure.

(3) Prevent steam flow from boiler in event of sudden line-header pressure drop.

LIFE AND PROPERTY PROTECTION. VALVES SINCE 1903

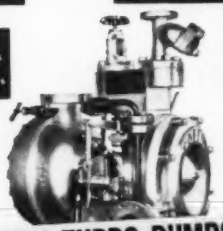
"Double Corliss" dashpot assembly prevents banging, chatter or spinning under any flow conditions. Write for technical catalog today.

In this large refinery installation 22 boilers are fitted with Golden-Anderson Non-Return Valves. They have given more than satisfactory service for over 35 years.

GA **GOLDEN-ANDERSON** *Valve* **Specialty Co.**

KEENAN BUILDING, Pittsburgh 22, Pa.

no other pump has so much to offer...


No destructive casing erosion or corrosion
Exact hydraulic and mechanical balance; light weight rotor, large bearings; result: bearing troubles practically unknown
All parts made to gauge and replaceable without fitting; all parts in stock at factory with wearing parts available from agencies' stocks
High efficiency pump plus high speed two-bucket raw turbine results in minimum steam consumption
Proved for performance over a period of more than twenty years in service
Pump gland leakoff provides adequate recirculation; suction pressure only on packing
Loss of suction reduces speed without tripping; automatic speed recovery with suction restoration
COFFIN TURBO PUMPS
Rigid one-piece steel casing plus heavy shaft plus ample clearances result in no damage from dry operation
Matched Pump, Turbine and Governors under one responsibility
Compact, light in weight, quiet and low in maintenance
Wide range exact pressure governing
No interstage leakage

compact . . . noiseless . . . vibrationless

10,000 hours continuous operation between inspections!

LEADING engineers in industry today look for better and more efficient equipment to cut costs AND boost production efficiency. That's why Coffin Turbo Pumps are being specified on an increasing number of jobs — *they deliver more dependable performance than any other comparable pump on the market.* Backed by more than 20 years experience, Coffin Pump specifications have been proved time after time on hundreds of installations. Check these specifications in your files the next time you want *real* pump performance — steam pressures to 850 psi . . back pressures to 200 psi . . pump capacities to 500 gpm . . . discharge pressures to 1100 psi . . heads to 2400 feet . . liquid temperatures to 300°F . . .

Complete description of Coffin Turbo Pumps are available on request or in the ASME Catalog or Sweet's File.

Specific proposals and application suggestions are available without obligation on receipt of operating data.

FREE! **A complete 4-page illustrated bulletin on COFFIN TURBO PUMPS with all operating data, applications, specifications that you may require for your next job. Write for Bulletin "S" today.**

REPRESENTATIVES IN PRINCIPAL CITIES.

INDUSTRIAL • RAILROAD • COFFIN • MARINE • PRODUCTS

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The J. S. COFFIN, JR., COMPANY

326 SOUTH DEAN STREET, ENGLEWOOD, NEW JERSEY

Nickel Industry in 1948

Robert C. Stanley, chairman and president of International Nickel Co of Canada, Ltd, stated in a review of the nickel industry that "total world deliveries of Canadian nickel in all forms for the year 1948 will set a new high peace-time record." "The two previous peace-time peak years were 1947 and 1937."

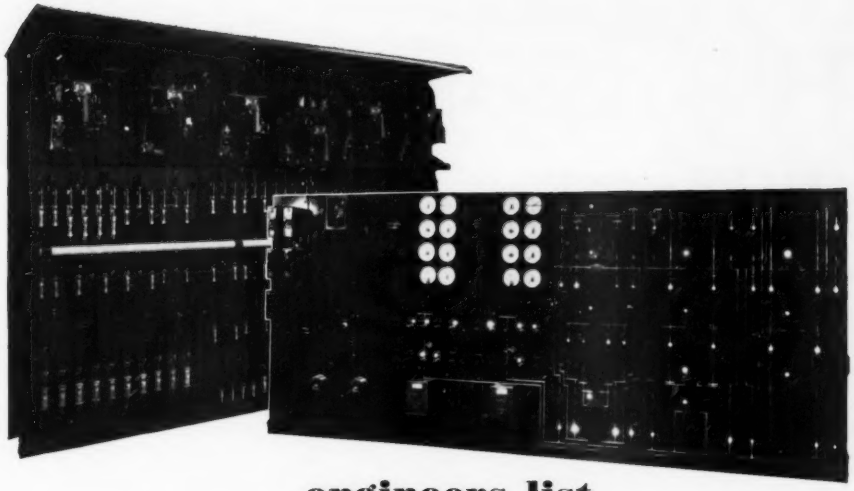
"The principal nickel companies in Canada," Stanley said, "operated at high levels during the year to supply the unprecedented peace-time demand for the metal. The French production from the New Caledonian nickel deposits, however, is reported to have been relatively small, with 1948 output estimated at well under that of the preceding year. Cuban production will not figure in this year's total as the mines in that country, which had been worked from 1943 to the early part of 1947, remained closed. Since Russia does not release information on metal production, it is not feasible to estimate that country's 1948 nickel output.

"The production of the Canadian nickel industry, in common with that of other industries in Ontario, has been hampered in recent months by electric power shortage brought about by the lack of rainfall during the summer and autumn. Power restrictions may continue throughout the winter months.

"During the latter half of the year prices quoted by International Nickel for electrolytic nickel were raised by reason of increased production costs, including supplies, services and labor, and the fact that the company must mine lower-grade underground ore bodies to continue a large and steady supply. These increases brought the price level of nickel to well above that prevailing in the pre-war years."

New White Star liner *Caronia* will make first application of single-automatic-extraction condensing turbines on shipboard. These units will be exclusively for power generation to drive the ship's dc electrical generators supplying the distribution system. The main propulsion units are triple-expansion impulse-reaction turbines geared to twin screws. Four automatic-extraction turbines drive 1100-kw 225-v dc generators through reduction gears at 600 rpm; turbine shaft speed is 4500 rpm. Turbines take steam at 550 psig, 775 F, bleed at 60 psig and exhaust at 1 in. Hg abs. Extracted steam will be used in the galleys and other low-pressure auxiliary services.

Babcock & Wilcox Co has announced release of a new 16-mm educational film, *Steam for Power*, which depicts development and application of modern steam boilers. This color film makes extensive use of animation and photography. It traces the important steps in the history of man's efforts to obtain ever more abundant and economical power by using steam to harness the energy released by combustion fuels. The film is available, without charge, to engineering and other professional societies, engineering schools, civic organizations and groups interested in power generation and utilization. Write to *advertising div, Babcock & Wilcox Co, 85 Liberty St, New York 6, N. Y.*



engineers list these 6 advantages of K&M EBONIZED ASBESTOS ELECTRICAL MOUNTING MATERIAL

For a safe, dependable apparatus paneling, more and more engineers are specifying K&M Ebonized Asbestos dielectric mounting material. These engineers say Ebonized Asbestos has these 6 advantages:

1. Unusually strong—both dielectrically and mechanically.
2. Highly resistant to shock, vibration, temperature changes.
3. Easy to machine, cut, drill, and handle.
4. Uniform consistency—no veins to cause chipping or cracking.
5. Versatile in use—supplied in various sizes up to 4" thick.
6. Neat, efficient appearance in finished units.

Ebonized Asbestos is a tough, dense sheet moulded of asbestos fibers, Portland Cement and an insulating compound. It is readily adaptable to such uses as switchboards, bus bar runs, compartment linings, testing tables, bench boards. When built into assembled units, it meets the technical requirements of Underwriters' Laboratories, Inc. Write us for further details—we'll answer your inquiry promptly.

Nature made Asbestos...

Keasbey & Mattison Company has made it serve mankind since 1873

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

IN CANADA—ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG AND VANCOUVER

TROUBLE-FREE
KEWANEE
SCOTTIE JR
• For 6 to 30 H. P. at 100 lbs. W. P. Like a steel bridge you can't wear it down. Every part is accessible and it's easy to handle. Truly trouble-free and economical to operate. For Oil, Gas, Coal.
For 6" Scale with pipe diameter markings—WRITE Dept 99-K2
KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

FLEXIBLE COUPLINGS

Everywhere two shafts are joined there exists the possibility of misalignment with its resulting wear-producing stresses. Flexible couplings, by taking care of out-of-line conditions, make for smooth-running and trouble-free machinery—every power engineer should know how they work and how to apply them.

The 16-page special in April POWER has the answers—the job flexible couplings handle, descriptions of leading types, pointers on installation, methods of calculating requirements.

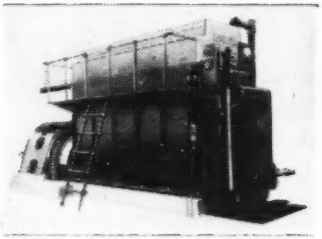
WATCH APRIL POWER FOR IT!

ELECTRICAL POWER—*NOW*

EXPORTERS — INDUSTRIES — MUNICIPALITIES

In line with Buckeye's new policy of building stock engines for SPOT DELIVERY we offer the following BUCKEYE DIESEL & DUAL FUEL ENGINES complete with necessary equipment for installation.

FULL DIESEL OR NATURAL GAS



NEW— CURRENT PRODUCTION MODELS

2—3 Cylinder Model 80SG diesel 154 HP generating units—514 RPM—100 KW—3/60/480 volts. DELIVERY FIRST UNIT—10 DAYS—SECOND UNIT—40 DAYS.

3—6 Cylinder Model "O" diesel 504 HP generating units—400 RPM—283 KW—3/60/2400 volts. DELIVERY 10 DAYS.

1—7 Cylinder Model 95S diesel—756 HP @ 360 RPM engine only—DELIVERY 60 DAYS, with generator to suit customer power requirements. DELIVERY 95 DAYS.

1—8 Cylinder Model 97SG diesel 960 HP generating unit, 360 RPM—643 KW—3/60/2400 volts. DELIVERY 30 DAYS.

Note: All of these units will provide 50 Cycle operation—they can also be gas operated. Call on BUCKEYE to help you out of your Power difficulties NOW—WIRE, WRITE, PHONE.

THE BUCKEYE MACHINE CO.

450 EAST O'CONNOR AVENUE **LIMA, OHIO**

ENGINE BUILDERS FOR 40 YEARS

More Power on The St. Lawrence

Over-all development of Lachini Rapids in the St. Lawrence River at Montreal, Canada, has been under consideration for a long time. This hydroelectric power and navigation project is again receiving serious attention. Latest engineering report proposes a 1,200,000-hp hydroelectric plant and a canal for 27-ft navigation.

Both the Canadian Government and Quebec Hydro-Electric Commission are interested in the project. It includes a dam 3500 ft below Victoria Bridge to maintain water level in Lake St. Louis at elevation 71.

Cost of the project will be $275,000,000, of which $47,000,000 is for navigation alone, $94,000,000 for power, $115,000,000 for navigation and power, and $19,000,000 for a 4-track railway tunnel. It is proposed that the Dominion Government assume $175,000,000 and the Province of Quebec $100,000,000 of the total cost.

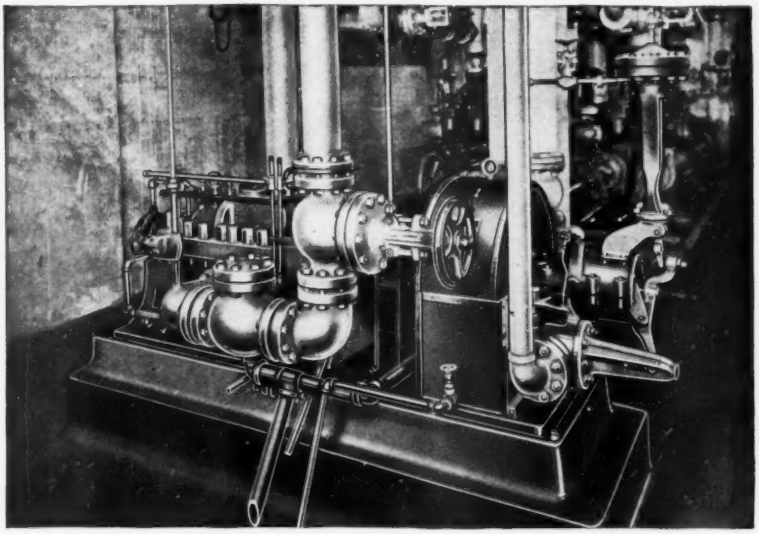
According to a recent report of J A MacKinnon, minister of mines and resources, Ottawa, construction of hydroelectric developments throughout the Dominion proceeded at high tempo during 1948, although some delays were experienced because of late deliveries of electrical and mechanical equipment and to shortage of some materials. Installed capacity in Canada, which now totals 10,931,018 hp, was increased during the year by 440,095 hp, the rate of expansion well exceeding the yearly prewar average of about 300,000 hp. A huge demand for electric energy, however, not only readily absorbed the output of new plants but was accelerating the greatest program of hydroelectric expansion in the history of the Dominion.

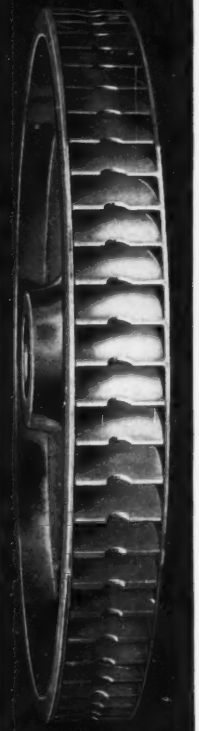
Plants under more or less advanced construction, which are expected to be completed or in partial operation within two years, will have a capacity of over 800,000 hp. Those on which preliminary construction has been started, or which are definitely planned, will add about 1,500,000 hp within five years. In addition, long-range plans envisage the development of many other sites that have been under investigation, a number of them being of high capacity.

Construction of a $10,000,000 power project on the Spray Lakes near Canmore, Alberta, by Calgary Power Co, Calgary, is now reported to have received approval by the Canadian government. Proposed plant would generate as much power as all other hydro plants in Alberta. Approval of the Alberta government has been received.

A $3,500,000 power plant to serve western Minnesota and eastern parts of the Dakotas will be built at Ortonville, Minn. Engineers of the Otter Tail Power Co, Fergus Falls, Minn., have been taking soundings for two months in Big Stone Lake that will furnish water power for the plant. The plant will serve a wide area between Wahpeton, N. D. and Canby, Minn.

TERRY





THE BLADES OF THIS BOILER FEED PUMP TURBINE ARE DOUBLE RIM PROTECTED

The 55 H.P. Turbine shown above employs the Terry Solid Wheel Rotor. The wheel is made from a single steel forging and the buckets are milled directly in the wheel.

The buckets are protected by rims at the sides of the wheel as shown in the illustration at the left. These rims would take without damage any rubbing that might occur if the clearance became reduced.

With this construction it is impossible for the blades to foul and frequent inspections of the thrust bearing are not required to obtain safe and dependable operation.

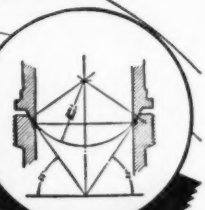
The Terry Wheel Turbine is fully described in our Bulletin S-116.

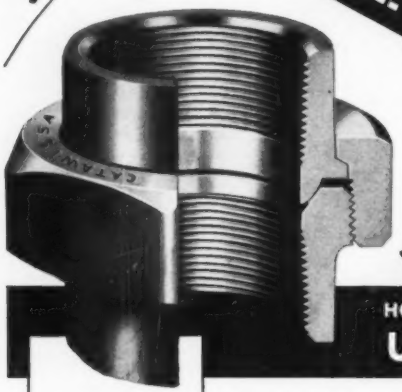
T-1170

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

CATAWISSA

BALL-TO-ANGLE SEAT gives you a PERFECT SEAL...





. . . even when the pipe is not perfectly aligned!

CATAWISSA

HOT FORGED STEEL

UNIONS

Full ACME Threads or U. S. Standard V-Threads in Union nuts and on female end.

STANDARD AND DOUBLE EXTRA HEAVY

HOT FORGED from solid, rectangular steel bars, Catawissa Pipe Unions are free-from sand and blow holes. The ball-to-angle seat design plus their ability to expand and contract with the pipe give you sure fire dependability . . . a perfect seal for every application!

CATAWISSA

STAINLESS STEEL

UNIONS

a type for every use!

MACHINED FROM SOLID STAINLESS STEEL BARS

Types 304, 316 and 347

Wherever caustic solutions are piped, Catawissa pipe union dependability is now available in corrosion-resisting Stainless Steel!

U. S. Standard V-Threads in Union nuts and on female end.

STANDARD AND DOUBLE EXTRA HEAVY

You specify the use and application, Catawissa will furnish a Stainless Steel Union recommended and guaranteed to give satisfaction! Standard and Double Extra Heavy types carried in stock. Specials made to order for socket welding, orifice plate, male-female or any other special use required!

IF IT'S A CATAWISSA . . . IT'S DEPENDABLE!

SEE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR . . . or write direct for complete engineering data and your copy of BULLETIN 10-A.

CATAWISSA VALVE & FITTINGS CO.

206 Mill St. • CATAWISSA, PENNSYLVANIA

Delegates and representatives from government and industry of Canada, the United Kingdom and the United States, met at the National Bureau of Standards, Washington, D. C. on Nov 18 and signed an accord on unification of American and British standard systems of screw threads. The accord, representing the culmination of 30 years of effort among the three nations, affirms the unification represented in revised publication of Interdepartmental Screw Thread Committee of the United States of America and of the British Standards Institution, Canadian Standards Assn and American Standards Assn. These documents fulfill all requirements for general interchangeability of threaded products made in the three nations. Not only is the accord of major significance in expanding and facilitating commerce between cooperating nations, but it is also an important step toward further development and extension of unifying standards in other fields of engineering practice. Write to National Bureau of Standards, U. S. Dept of Commerce, Washington 25, D. C., for Technical Report 135, entitled *Report on Unification of Screw Thread Standards.*

City of Anthony, Kansas has awarded contracts for improvements to municipal power plant as follows: (1) steam-generating unit to EdgeMoor Iron Works, Inc, EdgeMoor, Dela. at $44,780 (2) erection of unit to Valley Construction Co, Marshall, Mo. at $14,920 (3) boiler feed pump to DeLaval Steam Turbine Co, Trenton, N. J. at $3042 (4) combustion-control instruments and panel to Bailey Meter Co, Cleveland, Ohio at $6772. Black and Veatch, Kansas City, Mo. are the consulting engineers.

Charles G Curtis, internationally known engineer and pioneer in field of gas turbines, was honored by American Society of Mechanical Engineers at its 69th annual meeting on Nov 30. At a dinner sponsored by Gas Turbine Power Div of the Society, at Hotel Pennsylvania, New York, he received the first annual award of that division, an engrossed certificate, citing him:

"For his pioneer work in the field of gas turbines, which resulted in his being granted, in 1899, the first American patent covering a complete gas turbine power plant. We hereby tender him this testimonial of appreciation for his efforts in the advancement of the Gas Turbine Art."

Curtis, who was born in Boston in 1860, is still active as president of International Curtis Marine Turbine Co, 2 Rector St, New York. He received the award from Dr John T Rettaliata, dean of engineering at Illinois Institute of Technology, and youngest dean of engineering in the country. Rettaliata is chairman of the Gas Turbine Power Div, organized just over a year ago, with R Tom Sawyer of American Locomotive Co as its first chairman.

American Standard Code for Pressure Piping, safety standard for all steam and power services, is to be completely revised, according to Frank S G Williams, new chairman of the committee that functions under American Society of Mechanical Engineers' sponsorship. The new code is to appear in 1950.

MEASURING SATISFACTORY PERFORMANCE

. . . IN EVERY TEST!

QUAKER PACKINGS ARE "PRE-TESTED" TO ASSURE PERFECT FIT, LONG LIFE, MAXIMUM EFFICIENCY

Packings to be efficient must be perfect in fit . . . must form a tight seal in pumps, flanges, valve stems, piston rods to prevent leaks . . . must be of exact quality to meet the operating requirements of specific conditions.

That's why Quaker Packings are "pre-tested." Carefully calipered for size and fit . . . painstakingly checked for quality. Above we see the final test, one of many pre-tests Quaker Packings must go through before they are ready for usage. Tests that are safeguards against costly leaks, troublesome shutdowns, loss of production.

There's a Quaker packing for every type of service—water, air, gas, oil, acids at extreme temperatures . . . all pre-tested for better performance.

HOSE THAT LASTS

. . . because it has been pre-tested to stand pressure and resist wear. Quaker Hose is available for use with air, water, steam, volatiles, acids and gases.

FOR PEAK HORSEPOWER

Quaker belts are pre-tested for every industrial need . . . belts of all kinds that assure peak efficiency under all operating conditions.

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Western Territory
QUAKER PACIFIC RUBBER CO • San Francisco 10 • Los Angeles 21 • Seattle 4

QUAKER

RUBBER PRODUCTS

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you'll want this book

because

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USE OF OAKITE MATERIALS IN STEAM CENTRAL STATIONS
not only the specialized materials but the methods: all designed to save you $

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USE OF OAKITE COMPOUND 32 FOR EQUIPMENT DESCALING
useable facts about safe, speedy Oakite descaling

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OAKITE

INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE

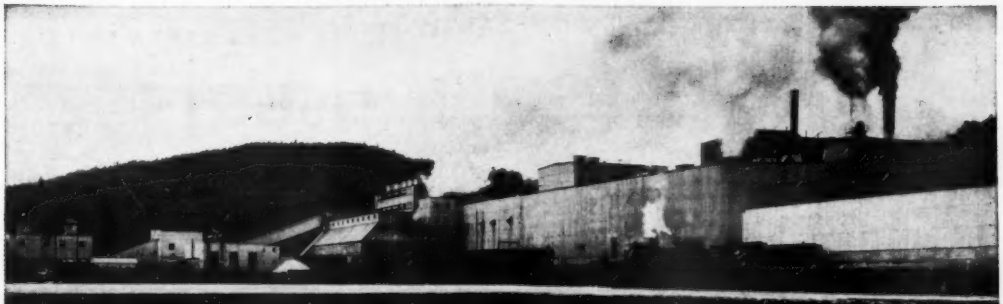
HOBART, TASMANIA, AUSTRALIA: A quick and cheap method of tapping gas and water mains has been developed in Australia. Geoffrey A Smith Co, 23-25 Melville St, Hobart, Tasmania, produces a nipple that taps and mills its way into piping and then remains in place. The nipple has milling edges and tapping edges. This enables a hole to be drilled and tapped in one operation. In conjunction with the nipple, the firm is planning to produce a simplified valve and a machine for screwing the valve and nipple into pressure mains or other piping, all in one operation. The nipple consists of mild steel and is case-hardened. The material satisfactorily taps cast iron as well as galvanized wrought-iron piping. The makers claim that it is possible to tap pressure mains without shutting down services.

BUENOS AIRES, SOUTH AMERICA: The first construction work has started in connection with the 500,000-kw Salta Grande Dam on the Uruguay River between Argentina and Uruguay, according to an official Argentine government announcement. Salta Grande, whose construction will be handled by a joint Argentine-Uruguayan commission already functioning, will be comparable in size and structure to Dnieperstroy Dam in Russia. It is about 300 miles north of Buenos Aires. Design work is expected to take one to two years, and construction will not likely get under way until 1950.

BANGKOK, SIAM: A part of Siam may be using hydroelectric power in three years following the recent signing of a survey agreement between the Siamese government and an American firm. The Minister of Industry, Mom Sanitwong Seni, and Clement R Tunell, representative of International General Electric Co of America, signed a contract under which GE will undertake a survey of the whole kingdom for hydroelectric resources. The survey will be done free of charge for the Siamese government and is expected to be completed within ten months. It will include technical as well as economic aspects.

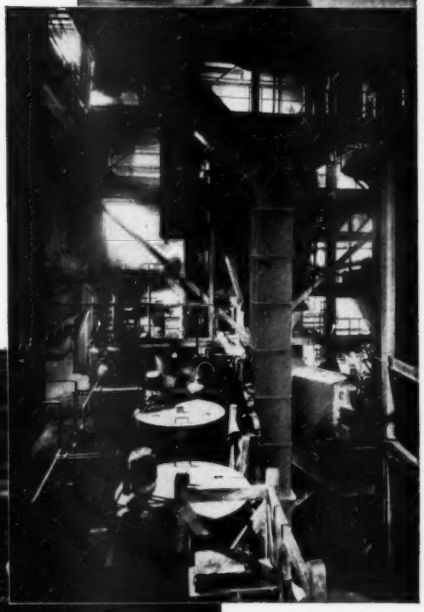
GE will send United States hydroelectric engineers to carry out the work, which is expected to be done partly by air. The company has offered to do the survey free of charge in the hope that with more people using electricity there will be more users of the appliances that GE manufactures. It will also tender for erection of the planned hydroelectric plants.

It is believed that the first hydroelectric plant will be constructed for Central Siam, including Bangkok. A network of irrigation canals will be developed to direct water from the plant's dam to rice fields.



. . . AS A SUPPLEMENTARY ORGANIZATION

To expedite the design and construction of a Pulp Mill for Marathon Paper Mills of Canada, Ltd., Stone & Webster Engineering Corporation established a supplementary organization of engineers, specialists and draftsmen to act as part of the client's own engineering department. The Engineering Corporation also furnished consulting advice on special phases of the project and supervised all the construction.



The Bleached Sulphate Pulp Mill of Marathon Paper Mills of Canada, Ltd., located at Marathon, Ontario, on the North Shore of Lake Superior.

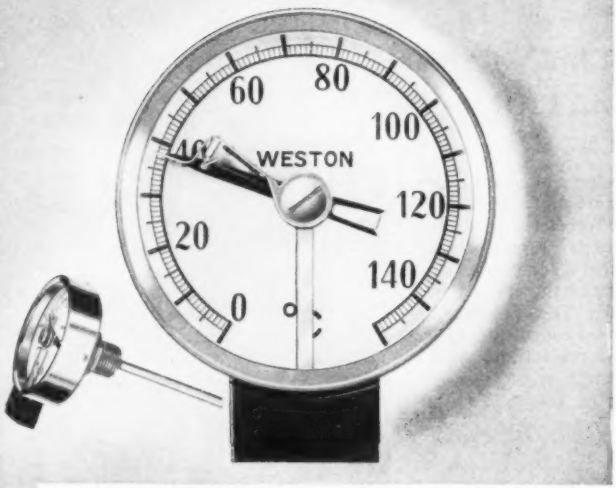
Above: Power and Recovery Boiler Room. Left: Machine Room — Dry End.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

NEW—

all-metal WESTON *Contact-making* thermometer



This new Weston combines the features of an indicating device with the advantages of an alarm or control instrument. A contact arm, mounted as shown above, is easily set to make contact at any temperature on the scale.

A terminal block on the periphery of the case makes electrical connection easy. The thermometer is all-metal, typically WESTON in ruggedness and reliability, with accuracy of ±1% as an indicating thermometer, and ±1½% as a contact making device. It is supplied in two types—for operation on either increasing or decreasing temperatures.

For complete information see your local WESTON representative or write Weston Electrical Instrument Corporation, 679 Frelinghuysen Avenue, Newark 5, New Jersey.

Industrial Thermometers | MAX-MIN Thermometers | Contact-making Thermometers

WESTON *Thermometers*

APPOINTMENTS

Appointment of Robert L Sommerville as Exide's assistant general sales manager is announced by Roland Whitehurst, vice-president in charge of sales. Sommerville, who has been in the employ of **Electric Storage Battery Co** for 30 years, brings to his new position a long and wide experience of the battery business from the engineering and merchandising angles. In 1916 he was graduated from Rensselaer Polytechnic Institute with the degree of Electrical Engineer, and is a member of Theta Chi and honorary scientific society of Sigma Zi. Sommerville is also chairman of statistical committee of Assn of American Battery Manufacturers.

Morton Salt Co, Chicago, names Harald M Olson its consulting engineer. Olson, water treatment engineer, water-equipment designer, salesman and maintenance engineer for over 39 years, continues his water-treatment endeavors in the field of municipal, industrial, commercial, institutional, domestic, and home-service base-exchange water softening, as well as in field of corrosion and other problems in this particular phase of water treatment. He is available for consultation through Morton.

Worthington Pump & Machinery Corp announces that manufacturing and distributing activities of its subsidiary, Ransome Machinery Co, are now conducted by the parent corporation. Operations for lines previously manufactured by Ransome are carried on at Worthington's Dunellen, N. J. works. Sales activities are directed from parent company's offices at Harrison, N. J, through Ransome sales div at Dunellen works.

Lionel Tinfow joins staff of **Pennsylvania Flexible Metallic Tubing Co.** Tinfow will be an industrial sales engineer working out of the New York branch under supervision of Sidney V Winton.

Taylor Forge & Pipe Works, Chicago, appoints Thomas J Lingle western div manager in charge of manufacturing operations at its Fontana, Calif. plant. He will also direct West Coast sales.

Roscoe Seybold has been named assistant to president of **Westinghouse Electric Corp,** with special responsibility for organizational planning, and budget and operating control. Also, C E Headlee has been made controller.

American Brake Shoe Co announces appointments of N George Belury and Philip H Clapp Jr as president and sales manager, respectively, of engineered castings div. Belury and Clapp continue to be at the division's headquarters in Rochester, N. Y.

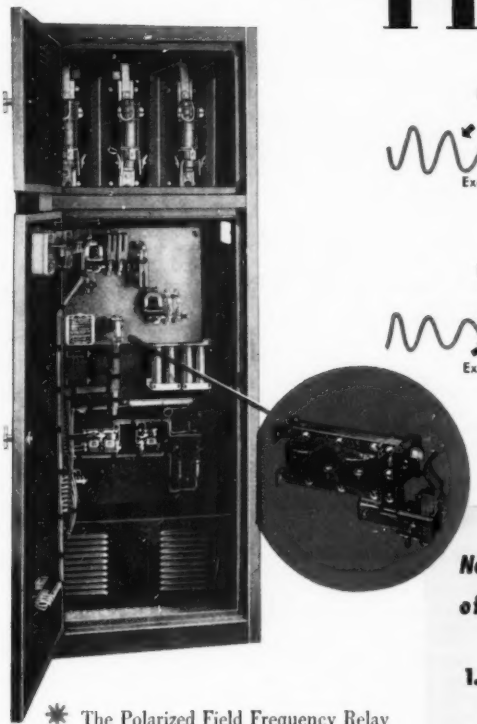
J B Scott is quality-control manager of **Borg-Warner Corp's** Ingersoll Steel div plant at Kalamazoo, Mich.

Lincoln Electric Co, Cleveland, announces following changes: C W Lytton is district manager for Buffalo, N. Y., area with office at 1700 Niagara St, Buffalo; C M

HERE'S HOW YOU GET

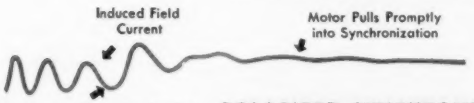
Perfect Motor Synchronizing

WITH **PFFR** *



INCORRECT SYNCHRONIZING

Excitation applied at unfavorable point, with resulting high surges of current and reversals of torque before synchronizing.



POLARIZED SYNCHRONIZING

Excitation applied at point that gives best synchronizing, with minimum current and maximum torque.

* The Polarized Field Frequency Relay Control System, an original E-M development perfected over many years, still continues to be accepted by the most competent engineers as the best control on the market. The reasons are that this system is continuously sensitive to motor speed and rotor position . . . applies excitation at just the right instant for the smoothest, most powerful synchronization on starting . . . provides for prompt resynchronization should the motor pull out of step from voltage dips or overloads. No other method can do these things . . . provide this simple, correct and wholly reliable method of synchronization. Polarized Field Frequency Relay is a key part of the Motor Control E-M has developed.

ELECTRIC MACHINERY MFG. CO.
MINNEAPOLIS 13, MINNESOTA

***Noteworthy are these other advantages of* E-M MOTOR CONTROL**

★ ★ ★

1. **Short circuit protection—with current-limiting and power fuses.**
2. **Motor isolating disconnects—fuses that can be swung open.**
3. **Complete motor protection—coordinated, pre-engineered control.**
4. **Safety for operators—metal enclosed units.**
5. **Adaptability for group lineup—sturdy, attractive, free standing and easily installed units.**

Call on your E-M field engineers for full details or write to us today for Bulletin 192.

E-M

SYNCHRONOUS MOTOR CONTROL

COMPLETE PROTECTION • CORRECT SYNCHRONIZING

3100-TPA-2076

Makes ALL VALVES *INSTANTLY* Accessible

CONTROL FROM THE FLOOR

● Instant, handy, safe control of overhead and other out-of-reach valves. Eliminate danger to employees; banish the stepladder. Now—install valves anywhere they should be, regardless of accessibility.

Inexpensive BABBITT Sprocket Rims fit all types and makes of valves, with either rising or non-rising stems. Installed quickly by clamping directly onto hand wheel of valve. Eliminates makeshift apparatus and specially-made chain wheels.

• Ten standard sizes take care of all valve wheels from 2 to 30 inches in diameter.

• *Request Catalog Bulletin P, prices, name of local distributor:*

Babbitt Adjustable SPROCKET RIM with Chain Guide

BABBITT STEAM SPECIALTY COMPANY

New Bedford, Mass., U.S.A.

EISLER TRANSFORMERS

STANDARD & SPECIAL

From ¼ to 400 KVA up to 15,000 volts

We manufacture a complete line of:

*AIR, OIL OR WATER-COOLED DISTRIBUTION TRANSFORMERS

**Special Designs available to meet Customers' Specific Requirements*

TRANSFORMERS FOR
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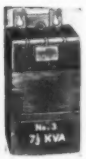
*WELDING
*HEATING
*PHASE CHANGING
Etc.



POWER & LIGHT TRANSFORMERS

For isolation of Light from Power, or Light from Telephone

EISLER TRANSFORMERS *are manufactured strictly to Standards of the N.E.M.A., A.S.A., and A.I.E.E.*

WRITE FOR SPECIAL CATALOG

EISLER ENGINEERING CO., INC.
Chas. Eisler, Pres.
757 South 13th Street, Newark 3, N. J.

Richard W Schreck serves as Michigan divisional sales representative for **Watson-Stillman Co.** Schreck works out of the company's Chicago office under direction of F G Helander, and also acts as special consultant on hydraulic machinery for two of Watson-Stillman's representatives —Frank T Goetz Machinery Co, Cleveland, and W K Millholland Machinery Co, Indianapolis.

Marcus Transformer Co, Hillside, N. J., names Lew C Conover, 100-A S 21 St., Philadelphia, as its territorial representative for eastern Pennsylvania, Delaware, Maryland, Washington, D. C., and south Jersey.

Richardson is district manager for northwestern Pennsylvania district with an office at 741 Liberty St, Franklin, Pa.; and Ray Zeh handles the Toledo, Ohio district with headquarters at 663 Spitzer Bldg., Toledo.

Herman B Robbins has been appointed manager of **Hill Diesel Engine div** of Drake America Corp, at Lansing, Mich.

Wheelco Instruments Co, Chicago, opens district office at 2204 Fannin St, Houston 5, Texas, under direction of George Hatfield. Territory includes Texas, Louisiana and New Mexico.

Claude M Lamb is named sales manager, industrial V-belt div, and assistant to vice-president in charge of mechanical sales of **Dayton Rubber Co,** Dayton, Ohio. R S Grove succeeds Lamb as New York district sales manager.

Rockwell Mfg Co has changed addresses of its Pittsburgh Equitable Meter and Nordstrom divisions to 25 Beale St, San Francisco 5, Calif., and 1102 Delano St, Houston 1, Texas, respectively.

Jonathan D Freeze joins **Jessop Steel Co** as district sales manager for New York territory. Freeze's headquarters are at 30 Church St, New York City.

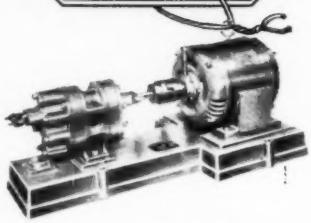
General Electric Co announces following changes in its divisions at Bridgeport, Conn.: In construction materials dept George Carlson becomes manager of manufacturing. Elmer E Sheldon is staff assistant to Carlson. Gordon H Howes is appointed supervisor of general accounting. Materials manager of conduit products div is Robert L Wakelee. Also, Alexander S Moody, commercial vice-president of **GE** in charge of customer relations in Northwestern states with headquarters in Portland, Ore., is now retired.

James D Willcox Jr. has been named district manager of **Elliott Co's** Houston, Texas, territory.

Carboloy Co, Detroit, appoints Harry Crump assistant to sales manager. J S Gillespie succeeds Crump as manager of tool and wear parts sales engineering. A F Dobbrodt is advanced to manager of mining sales engineering.

Chain Belt Co, Milwaukee, announces establishment of a warehouse at 878 Ashby

MAINTENANCE CREW *HANDS OFF!* --*it's a* SIER-BATH ROTARY PUMP



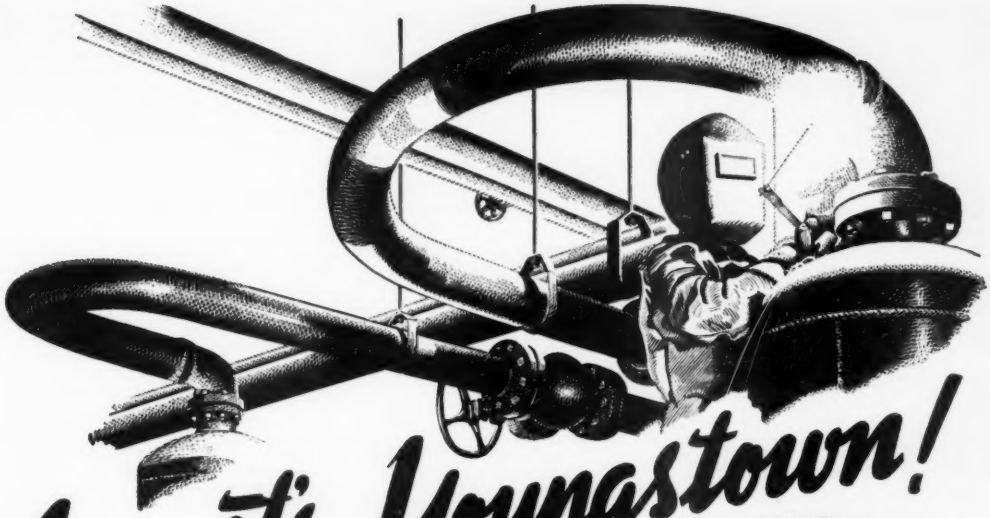
Sier-Bath Screw Pumps and Gearex Pumps are designed to do a job—and keep doing it. The manufacturer has a full appreciation of the high cost of interrupting the operation of a line to permit pump repairs. On the Internal Gear-type Screw Pump, for example, the gland is the only point of attention and as this is on the suction side, it is almost negligible. It is not unusual for the packing to last two years without repacking. The pressure on the gland is so slight that it is possible to add a new ring of packing without shutting down the unit. Send for information.

ALSO MAKERS OF SIER-BATH PRECISION GEARS

FOUNDED 1905 MEMBER A.G.M.A.

Sier-Bath GEAR and PUMP CO., Inc.

9254 HUDSON BLVD NORTH BERGEN, N J



Yes, it's Youngstown!

Dependable Steel Pipe ...Easy to Install

THROUGH the years, the guiding principle at Youngstown has been to make quality steel pipe which is well suited to serve the needs of plumbing and heating contractors and their customers. That's why Youngstown Pipe bends accurately, cuts readily, threads surely, welds easily--properties designed into the product for efficient fabrication, installation and long, satisfactory service.

Youngstown

STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

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PIPE AND TUBULAR PRODUCTS · CONDUIT · BARS · RODS · COLD FINISHED CARBON AND ALLOY BARS · SHEETS · PLATES · WIRE · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · RAILROAD TRACK SPIKES.

RECOMMENDATIONS ON MAGNETIC SEPARATORS for taking Tramp Iron out of Coal

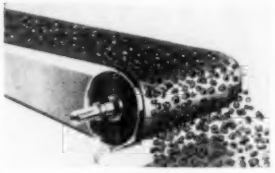
THERE is a Dings Magnetic Separator for every power plant or boiler room requirement . . . from the big 48" x 48" electromagnetic pulleys used by modern central stations to the little Alnico Perma-Plate magnets for plants using small stoker-fired heating boilers. Detailed descriptive literature and recommendations from Dings engineers are available on request to help you select the separator best suited to your needs.

MAGNETIC PULLEYS

Magnetic Pulleys are recommended on the majority of belt conveyor installations because they *automatically* remove and discharge the tramp iron.

NEW! THE ALNICO PERMA-PULLEY—magnetic permanence *guaranteed* for the life of the installation . . . powerful, trouble-free. Suitable for most pulley requirements. Ask for Catalog C-1007A.

AIR-COOLED ELECTROMAGNETIC PULLEY—recommended for very heavy burdens because of great depth of magnetic flux penetration. Catalog C-1001A.

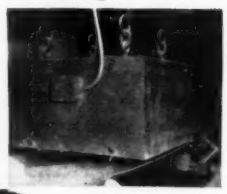


RECTANGULAR ELECTROMAGNETS

Uniform magnetic flux pattern across entire face of magnet, plus great depth of magnetic penetration and high surface strength, make Dings triple pole rectangular magnets the most powerful tramp iron magnets available.

CHUTE TYPE—stepped face helps arrest and hold iron mechanically as well as providing extra magnetic edges for intense magnetic concentration. Available with automatic safety gate to stop flow if current is interrupted; gate also used to remove accumulated iron. Catalog 301-A.

SUSPENDED TYPE—recommended for use above belt where pulley is not applicable due to excessive speed, burden depth or other reasons. Also used above chutes. Available in AUTOMATIC SELF-CLEANING TYPE with cross belt which discharges iron to the side. Ask for Catalog 301-A.



NEW! PERMA-PLATE MAGNETS

Here's low cost, powerful, permanent magnetic protection. For installation above or in chutes and above belts. Ideal for stoker protection. Non-electric; magnetic permanence *guaranteed* for life of installation. Send for Bulletin B-1205A.

Dings MAGNETIC SEPARATION HIGH INTENSITY

DINGS MAGNETIC SEPARATOR CO.
4765 W. McGeogh Avenue
Milwaukee 14, Wis.

Separation Headquarters Since 1899

St, N W, Atlanta, Ga. The Atlanta district office is also at this address under direction of J S Moore, district manager. Under supervision of G J Schuelke, the warehouse serves entire Southeast including North and South Carolina, Virginia, Georgia, Florida and Alabama.

Frank E Early will represent **Askania Regulator Co** in Detroit, Mich. His address is 15234 Michigan Ave.

Lewis B Kinney is the representative in Colorado for **Babcock & Wilcox Tube Co.** Kinney maintains an office at 1728 Stout St, Denver.

Hewitt-Robins, Inc has reappointed Walter K Benchley as purchasing agent for its Hewitt-Rubber div and William A Fleischman has been named purchasing agent for Restfoam div. Both plants are in Buffalo.

A Edward Jennens becomes district manager for **Cardox Corp** with headquarters in Stephenson Bldg, Detroit, Mich. Jennens succeeds Albert C Wallich, who has retired to enter business for himself.

Oakite Products, Inc promotes Frank L Oldroyd to sales manager of its industrial div. Oldroyd will direct activities of industrial field staff from the company's general offices in New York.

E H Walker, general manager of Shell's personnel and industrial relations organization, is now a vice-president of **Shell Oil Co,** New York.

Bowser, Inc, Fort Wayne, Ind., names Gerald J Klopfenstein assistant to vice-president and director of sales, Fred S Ehrman. James E Doelling assumes Klopfenstein's former position as manager of meter sales div.

A W Wagner is appointed general parts div manager of **Thew Shovel Co,** Lorain, Ohio. Wagner will temporarily continue as manager of parts div sales in addition to being responsible for supervision of Thew plants No. 3 and 5 in Elyria.

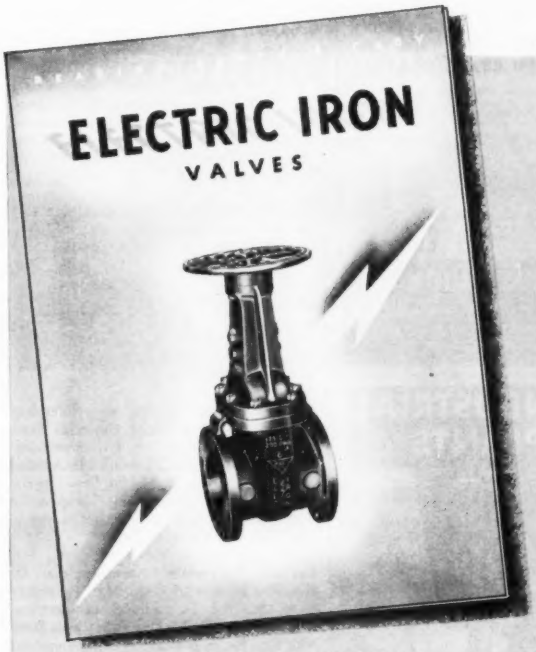
Cyclotherm Corp, Oswego, N. Y., has made J Parker Thompson Co, 507 Fifth Ave, New York City, its factory distributor for southern New York and northern New Jersey. E J Zisek of Thompson Co becomes sales manager in charge of Cyclotherm sales and service. The Thompson organization has acquired sales and service personnel for its territory heretofore managed at Cyclotherm's general offices, 90 Broad St, New York City.

Ernst R Habicht becomes assistant production manager of **Du Pont Co's** ammonia dept. Habicht's headquarters are in Wilmington, Del. At the Belle, W. Va., works. Fred A Otto and John R McConnell are promoted to manager and assistant manager, respectively.

Institute of Power Engineers has re-elected Walter J Cummings president of its Hamilton (Ont.) chapter. Other officers elected are: C S Izatt, vice-president; George W Smith, secretary-treasurer; V H Jack and W J Cummings, board of gover-

BETTER IRON MAKES BETTER VALVES AT READING-PRATT & CADY

There is one *BEST* method of melting and refining iron for valve castings. It is R-P&C's *Electric Furnace method.*

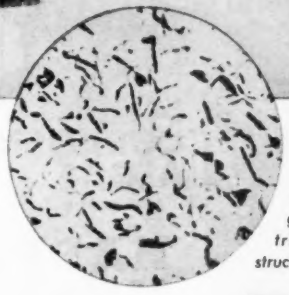


THIS FOLDER tells you why Electric Iron is better than iron made by the conventional cupola process. Interesting information if you buy or specify iron valves. Write for DH-18.

YOU PAY NO PREMIUM for the extra quality in R-P&C Electric Iron Valves. But you do get better valves — longer lasting, more dependable.

Electric Furnace Cast Iron is a low-sulphur, low-phosphorus iron of homogeneous, fine-grained structure. It is clean and of uniform quality.

Before buying or specifying iron valves, get the complete story of R-P&C Electric Furnace Iron. Write for our descriptive folder—DH-18.



UNIFORM STRUCTURE
Photomicrograph (enlarged 100 times) shows even distribution of fine graphite flakes. This contributes to the uniform structure of R-P&C Electric Iron.

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New York • Philadelphia • Pittsburgh • San Francisco • Bridgeport, Conn.

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"GUNITE" Concrete

(SINCE 1915)

Linings for

STEEL BUNKERS •
DUCTS, HOPPERS •
STACKS •
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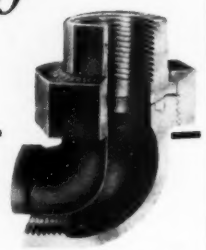


All-Female 90° Union Elbow. Made also in Male - Female type.

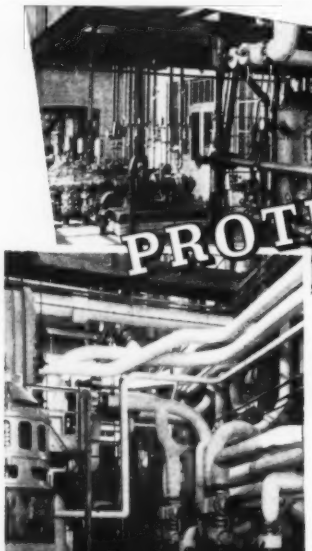
Improve and Simplify Piping Jobs . . . Use the Air-Refined Malleable Iron UNIONS . . . with the RECESSED BRASS SEAT

The All-Female Union Elbow, like all Jefferson Specialty Unions, is a time, labor and material saver. It takes the place of a straight union, nipple and elbow, and eliminates two pipe joints. It simplifies complicated piping installations, and reduces the number of points where leaks could occur.

An exclusive feature of all Jefferson Unions is the Recessed Brass Seat which is located in a protected position and leaves a straight bore for unrestricted flow.

Get in touch with your nearest distributor . . . or us direct . . . for full details of the complete Jefferson line.

JEFFERSON UNION CO.
605 W. 26th St., New York 1, N. Y.
63 Gooding St., Lockport, N. Y.
39 Fletcher Ave., Lexington 73, Mass.



INDUSTRIAL PLANTS
PROTECTED
from
SCALE
CORROSION
ALGAE
by
HAERING
ORGANIC
GLUCOSATES*

* REG. U. S. PAT. OFF.

WE READ WATER
D. W. HAERING & CO., Inc.
GENERAL OFFICES:
205 West Wacker Drive, Chicago 6, Ill.

WRITE ON YOUR LETTERHEAD FOR SPECIAL LITERATURE

nors; W Eby and E R Moorgate, auditors; E T Clarke, legislative committee; J V Moran, entertainment and education; William Hoye, sick committee; W O Jack, warden (a new office); J V Price, membership committee; V H Jack, planning and development; K Shepard, question box; George E Bindon, publicity.

Fred H Schaub Engrg Co, Chicago, announces appointment of Frank T Settle as field sales engineer for all Schaub products and equipment.

Felix A Mulgrew joins business department of **Burns & Roe, Inc,** engineers and constructors of power plants.

American Society for Metals names Taylor Lyman associate editor of its publication, *Metal Progress*. Ernest E Thum continues as editor-in-chief.

H Blake Thomas, general sales manager of McQuay, Inc, Minneapolis, is elected chairman of lowside equipment product section of **Refrigeration Equipment Manufacturers Assn.** Thomas will serve his term until April 1950.

Orest A Meykar has been granted the diploma to practice professional engineering by New York State, and is opening an office at 2817 Astoria Blvd, Long Island City 2, N. Y. Meykar will handle mechanical engineering problems.

Boston Edison Co grants George U Parks title of assistant superintendent of production—steam stations.

D R McClung, general superintendent, **Pacific Power & Light Co,** with headquarters at Portland, Ore., is vice-president in charge of physical operations. Another promotion makes L A Morphey superintendent of power, responsible for operation and maintenance of production, transmission and substation facilities.

Cornell University announces that Dr Henry G Booker of Cambridge University joins the staff as professor of electrical engineering. Booker will be associated with Dr Charles R Burrows in development of research program and in academic activities of School of Electrical Engineering.

OBITUARIES

David P Graham, 46, vice-president, Peabody Engrg Corp, New York City, died Dec 18 at his home in Westbury, L. I.

Carl H Graesser, 62, vice-president in charge of engineering at Manning, Maxwell & Moore, Inc, Bridgeport, Conn., died Dec 18 in his home at Southport, Conn.

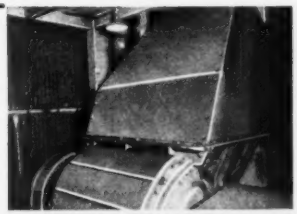
Charles J McAuliffe, 59, stationary engineer at Delaware, Lackawanna & Western Coal Dock, Buffalo, died Nov 23 in a Buffalo hospital.

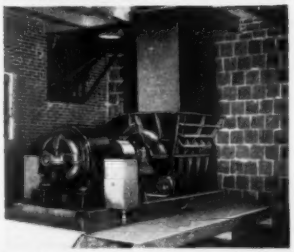
William Carty, 69, stationary engineer at Hotel Ten Eyck, Albany, N. Y., died Nov. 26.

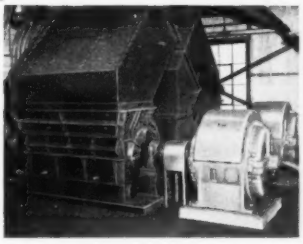
(*Continued on page* 224)

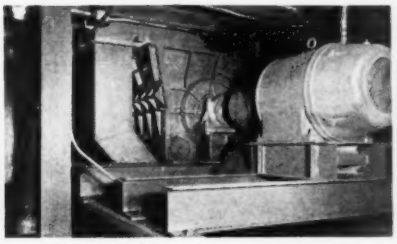
A COMPLETE COAL CRUSHING OPERATION in less than 12'x12'x12'

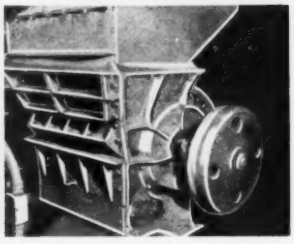
American Rolling Ring Crushers provide high tonnage reduction with controlled uniform sizing



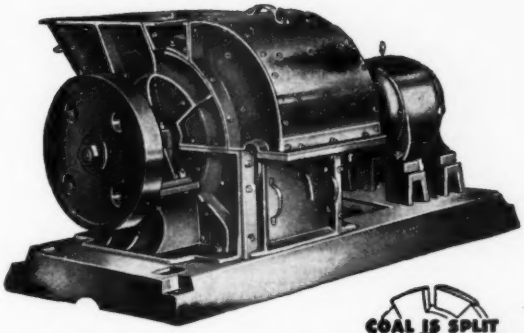








Americans are contributing to greater firing efficiency in power plants everywhere. ROM coal is rapidly reduced to stoker or pulverizing sizes in one low-cost operation. A complete, compact crushing operation requiring only minimum headroom and no auxiliary crushing or breaking units, Americans incur little or no extensive plant alterations. American Rolling Ring Crushers are built in capacities up to 500 TPH.



Only Americans offer the patented shredder ring action that *splits coal* by efficient cleavage action of multiple cutting edges.

COAL IS SPLIT - NOT CRUSHED

Get the data on improved coal preparation— Send for Americans "S" Crusher Bulletin.

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

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HANDLES WATER ALMOST AT THE *Boiling Point*

Water and Air being discharged to Air Separating Tank
Air, Vapor and Condensate from Accumulator Tank
Water under pressure being supplied to Jets by the Centrifugal Pump

If excessively hot condensate is causing pump trouble in your heating plant, Hoffman-Economy offers positive relief. The exclusive Jet-Type Vacuum Producer featured in the Hoffman-Economy Vacuum Pump assures efficient operation under conditions ordinarily impossible. *It is the simplest and most effective method for exhausting air and water at high temperatures,* simultaneously. Loss of efficiency because of wear does not occur since close clearances are not required.

In every other respect this pump is built to meet and even anticipate modern pumping requirements. All cast iron and bronze construction... stainless steel shaft — noiseless . . . and easy accessibility to all parts.

HOFFMAN VACUUM and CONDENSATION PUMPS
are now available in a wide range of types and capacities due to increased production.

HOFFMAN ECONOMY PUMPS

Send for illustrated catalog.

HOFFMAN SPECIALTY CO.
Dept. AR-2, 1001 York St.
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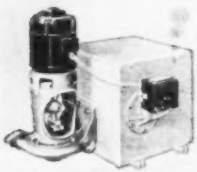
Famous for Hoffman Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems.



Hoffman-Economy Type "E" Condensation Pump with vertical pump and motor assembly.

William F. Ambrose, 69, stationary engineer with Rochester Folding Box Co, Rochester, N. Y., died Dec 3 after a short illness.

Clinton W Bedell, 69, consulting engineer specializing in heating problems at Boston, Mass., died Nov 26 in Arlington, Mass.

Frank H Mason, 69, chief engineer, Nepsco Services, Inc, Augusta, Me., died Dec 17 in that city.

William D Halsey, 58, chief engineer of boiler div, Hartford Steam Boiler Inspection & Insurance Co, died Dec 9 at his home in West Hartford, Conn.

Robert T Kain, 48, manager of the Dallas district of industrial products sales div, B F Goodrich Co, died Dec 2 of a heart attack in that city.

Adaptation of Cooper-Bessemer's *Turboflow* development of the 4-cycle gas engine is estimated to produce 14% more power while cutting fuel costs by at least 20%, according to a recent statement by Gordon Lefebvre, president and general manager. The new unit is expected to be in production by July 1949. First announcement of the *Turbojlow* development was made by Cooper-Bessemer a year ago in connection with the 2-cycle natural-gas engine. The new 4-cycle engine will discard the standard fuel-mixing valve and utilize in its place a simple gas-injection system similar to that used on the company's atmospheric gas-diesel engines. The development is particularly significant at this time, Lefebvre says, because of rising price of fuel oil, as compared with natural gas.

The Manitoba government will construct a dam and power plant on the Winnipeg River, about 70 miles northeast of Winnipeg, at an estimated cost of $15,000,000 to $20,000,000, Premier Campbell announced. The premier said contracts will be let immediately for the project at Pine Falls. It will not be completed until the fall of 1952, but two of six producing units will be in operation by the fall of 1951. While total capacity of the plant will be 114,000 hp, it will not provide sufficient power to meet long-range power shortages seen likely to occur by 1954.

As part of Cincinnati, Ohio, 5-year multimillion dollar improvement program new pumps are being installed that will increase the city's water supply 150 gal per day. Two of the new pumps will be 2-stage, powered by 3000-hp motors, each good for 25 million gal of water daily to the Eastern Hills system, at about 200 psi. One 2-stage pump, for Eastern Hill, is rated at 20 million gal per day and driven by 2500-hp variable-speed motor. Three single-stage pumps, rated at 25 milion gal per day, powered by 1250-hp motors, will supply 75 million gal at 75 psi to the Central Service System. All pumps are being built by Worthington Pump and Machinery Corp and all pump motors, controls and accessory equipment will be General Electric's.

EXIDE BATTERIES

for peak performance in Diesel engine cranking

You can always count on Exide Batteries for ample power and peak performance in Diesel engine cranking. That's because they're designed and built specially for the job . . . by engineers who for many years have been closely associated with the problems of Diesel engine starting.

The extra capacity, rugged construction and trustworthy service of Exide Diesel Cranking Batteries are proved daily in every field—on trucks, buses and off-the-highway equipment . . . in ships and railway locomotives . . . in power plants. For dependability, long life and low cost maintenance, choose Exide Batteries for all your battery cranking.

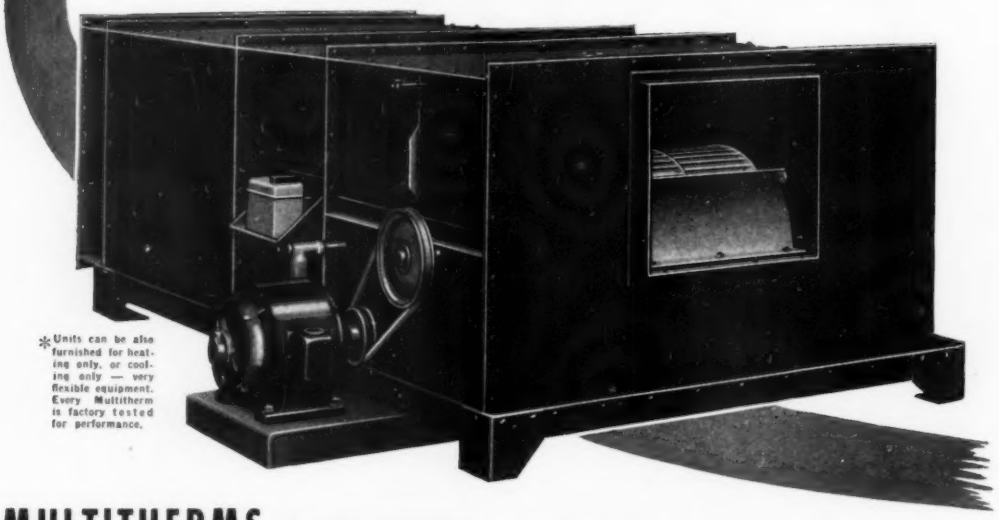
1888—Dependable Batteries for 61 Years—1949

Exide
BATTERIES

"Exide" Reg. Trade-Mark U. S. Pat. Off.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited,* ***Toronto***

HERE'S ONE OF THE MOST EFFICIENT WAYS TO AIR CONDITION!



*Units can be also furnished for heating only, or cooling only — very flexible equipment. Every Multitherm is factory tested for performance.

MULTITHERMS—WHOLE "WORKS" IN ONE ASSEMBLY . . . BUILT FOR ALL SORTS OF INDUSTRIAL AND COMMERCIAL APPLICATIONS

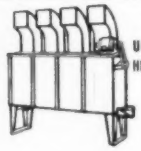
The Clarage Multitherm unit shown above is a complete conditioning plant* . . . (1) it *cleans* the air, removing bacteria, pollen and dust . . . (2) it *cools and dehumidifies* in summer utilizing cold well water, brine or a direct expansion refrigerant . . . (3) it *heats and humidifies* in winter using steam or hot water . . . (4) it supplies at all times a circulation of conditioned air under positive fan pressure.

Multitherms are as easy and inexpensive to install as unit heaters — and just as satisfactory in operation. They may be suspended from the ceiling, mounted on platforms, or installed on the floor. Sizes range from 400 to 13,600 c.f.m. If the job is extra large, it can be handled with two or more units.

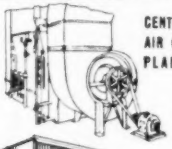
Look into Clarage Multitherms if you have any type of air conditioning problem. They are engineered to give precision results — compact to save space — of heavy duty construction for years of continuous trouble-free service. *And, as compared to central station conditioning, you can usually save considerable money.*

Write us, outlining your requirements — or ask for Bulletin 107 giving complete information.

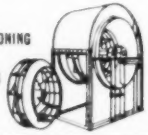
SOME OF OUR OTHER PRODUCTS



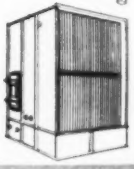
UNIT HEATERS



CENTRAL STATION AIR CONDITIONING PLANTS



AIR CONDITIONING AND VENTILATING FANS



AIR WASHERS

CLARAGE
FAN COMPANY
Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

Presenting

a pictorial record of standard and special built HEAT TRANSFER EQUIPMENT

by **Vogt**

You are invited to send for this record of ingenuity in heat exchanger design and construction.

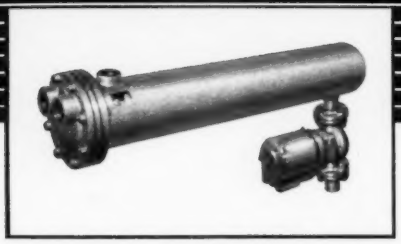
Shown, among examples of the many types we build, are units for diversified applications, high pressures, and special operating conditions as well as conventional types for ordinary exchanger services in petroleum refineries, chemical plants, process industries, power plants, etc.

Thousands of installations in successful operation attest to Vogt's ability to give effective help in the solution of heat transfer problems peculiar to a wide variety of operating conditions.

Write for a copy of Bulletin HE-5, on your letterhead.

HENRY VOGT MACHINE CO.
INCORPORATED
LOUISVILLE 10, KENTUCKY
BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS

For More Hot Water At Lowest Cost



TYPE "SU" INSTANTANEOUS WATER HEATER
for heating water with steam

Here's the economy heater for industrial plants where large volumes of water are required continuously for service water supply or process work. No storage tank is required, thereby saving space and money. The abundance of heat transfer surface in these units heats water instantly as it is needed.

The tube bundles of "SU" Heaters are of "U"-bend construction which provides full compensation for expansion strains. The tubes are amply supported, preventing wear and assuring proper steam distribution.

B & G Type "SU" Water Heaters are made in 2 and 4 pass units and in a complete range of capacities. They are easily connected to any steam boiler or system.

Write today for catalog.

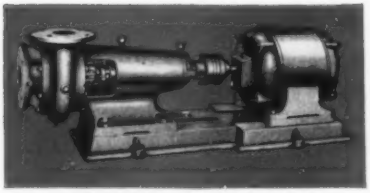
TYPE "WU" INSTANTANEOUS WATER HEATER
costs less to install—less to operate

The "WU" Heater (water to water heat transfer) is equipped with a B & G Booster which pumps boiler water through the shell, thereby greatly increasing the capacity of the Heater.

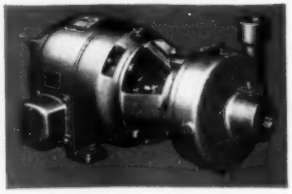
Whenever water temperature goes below the desired degree, the Booster pumps boiler water through the shell of the heater until service water is again at the correct temperature.

Because of pumped circulation, the connecting pipes and fittings are radically reduced in size and cost. No storage tank is needed.

B & G CENTRIFUGAL PUMPS



B & G Series 1510-15 flexible coupled Centrifugal Pump



B & G Series 1522 Centrifugal Pump with integral motor

These catalogs of B & G Centrifugal Pumps will be sent to you upon request

Hydro-Flo* PRODUCTS

Forced Hot Water Heating Systems . . . Heat Exchangers . . . Water Heaters . . . Pumps . . . Refrigeration Equipment

BELL & GOSSETT COMPANY

Dept. AW-36, Morton Grove, Illinois

*Reg. U. S. Pat. Off.

HELPS SINK A 14,000-TON PROBLEM

Penflex flexible metal hose provides efficient, time-saving service as jet feeder lines on tunnel project

Sinking a 14,000-ton caisson 70 ft. into a sand island is a tough nut to crack. One of the problems confronting engineers was the need for flexible jet feeder lines, to transmit water at high pressure up over the top and down to the jets at the bottom of the caisson.

These jets force away sand on which the caisson rests, allowing it to settle gradually as the top sections are built up. This constant changing of the top level made flexiblity a "must" for jet feeder lines—but with Penflex "Flexineering" on the job, the problem vanished.

Penflex engineers recommended the installation of 4" interlocked flexible metal hose, thus eliminating the need for connecting and disconnecting rigid pipes, saving time and labor. Penflex hose is plenty flexible . . . resists high pressure . . . assures tight, free-flowing service.

When flexible tubing problems bog down efficiency and production in your plant . . . when you need flexible, leak-proof transmission of liquids, air, gas, or light solids, consult Penflex for "Flexineering" service (the science of engineering each type of flexible tubing to the problem). And for a complete line of flexible metal hose, tubing, and couplings from ⅛" I. D. to 30" for all purposes, write today to . . .

PENNSYLVANIA FLEXIBLE METALLIC TUBING COMPANY

7238 Powers Lane **Philadelphia 42, Pa.**

BRANCH SALES OFFICES—BOSTON • NEW YORK • CLEVELAND • CHICAGO • HOUSTON • LOS ANGELES

Penflex... HEART OF INDUSTRY'S LIFE LINES

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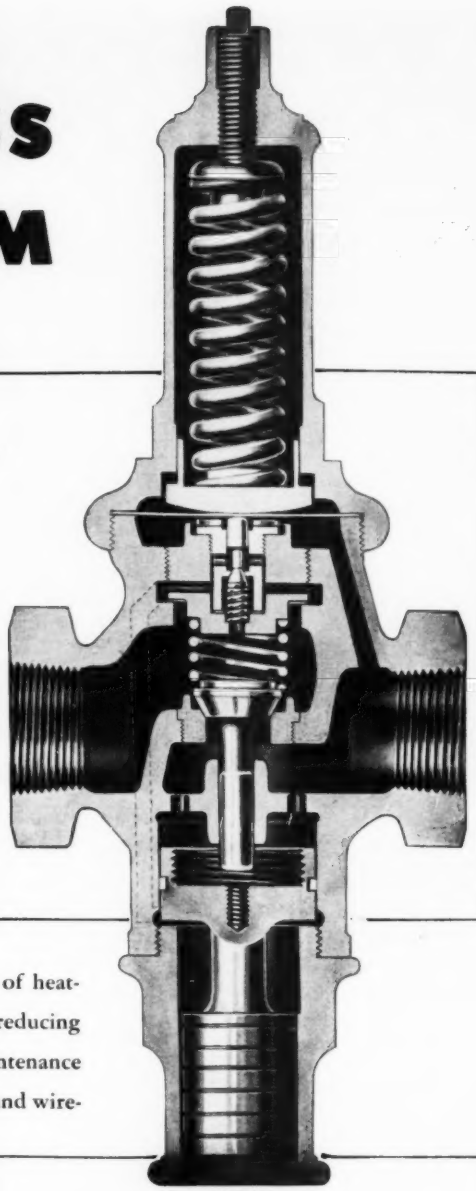
STAINLESS STEEL TRIM

Reduces Maintenance . . .
Assures Longer Operating Life of . . .

MASONEILAN No. 11 Reducing Valves



Because the pilot, valve and seats are made of heat-treated stainless steel, Masoneilan No. 11 reducing valves give accurate long life and reduce maintenance by minimizing valve sticking, steam-cutting and wire-drawing. And remember this stainless steel trim is standard . . . costs you no more. Investigate and install Masoneilan No. 11. These regulators will save you money by staying in service longer. Write for catalog, today.

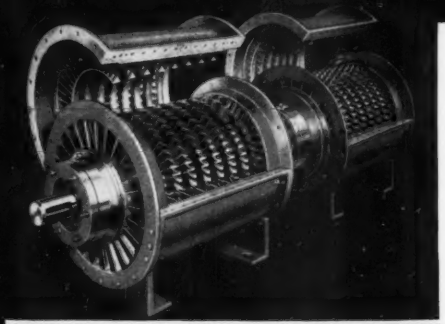
MASONEILAN

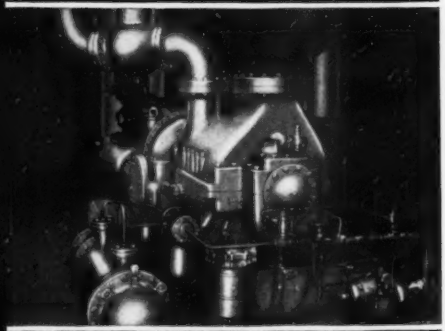
MASON-NEILAN REGULATOR CO.

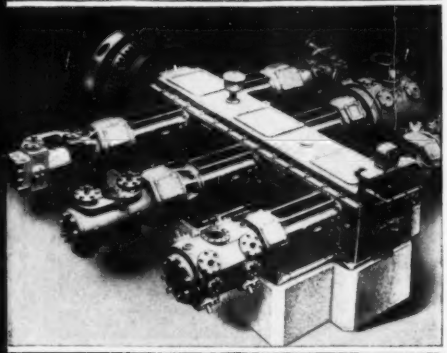
1186 Adams St., Boston 24, Mass., U. S. A.

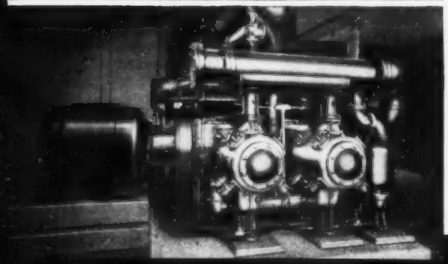
New York • Philadelphia • Buffalo • Pittsburgh • Tulsa • Cleveland • Chicago
Atlanta • St. Louis • San Francisco • Los Angeles • Houston
Mason Regulator Co. of Canada, Ltd., Montreal and Toronto

Cut Costs with these CLARK COMPRESSORS









CLARK AXIAL FLOW COMPRESSOR—Clark Axial Flow Compressors are high-capacity, high-efficiency machines, especially valuable in the volume range of 20,000 to 300,000 CFM. Adiabatic efficiencies up to, and frequently in excess of, 85 per cent are available in industrial units.

These units are suitable for either electric motor, steam turbine or gas turbine drive. Gas turbine drives, reflecting the most recent developments in design and research, are built by Clark Bros.

CLARK CENTRIFUGAL COMPRESSOR—Clark Steam-Turbine-Driven Centrifugal Compressors are designed for direct drive by steam turbines operating either non-condensing or at high vacuum. They meet power requirements up to 25,000 BHP and speeds as high as 12,000 RPM.

This compressor is also available as an electric motor-driven unit or as a gas-engine-driven unit, through a standard speed increasing gear.

ELECTRIC-DRIVEN RECIPROCATING COMPRESSOR—Compact in design, the Clark Electric-Driven Compressor requires a minimum of floor space. Smooth operation and low maintenance cost are assured by its balanced-opposed design. All component parts are so constructed as to make the unit adaptable to a wide range of services such as synthetic ammonia, ammonia refrigeration, natural gas booster plants and many others.

Clark Electric-Driven Compressors are built in three different classes:

The CMA (8" stroke—600 RPM) with 2, 4 or 6 compressor cylinders and a horsepower range from 150 to 600 BHP.
The CRA (14" stroke—300 RPM) with 2, 4 or 6 compressor cylinders and a horsepower range from 500 to 2000 BHP.
The CBA (17" stroke—300 RPM) with 4, 6 or 8 compressor cylinders and a horsepower range from 1750 to 4500 BHP.

ELECTRIC-DRIVEN SOOT BLOWER—Recent developments in soot blower equipment prove the economy of using compressed air furnished by electric-motor-driven compressors as a soot-blowing medium. The Clark CTMA-3, with an 8" stroke and operating at 600 RPM, is an ideal unit for this service, because of its high piston displacement and minimum floor space requirement.

Boiler make-up is reduced from 1½% required by steam blowers to less than ½% with the Clark Soot Blower. Energy consumption, as measured by the coal pile, is reduced by 6.5 tons of coal per day.

The Clark Soot Blower Compressor, rugged yet simple in construction, is designed for inherent running balance with trouble-free service over long periods of continuous operation.

Send for complete information on these moneysaving units.

CLARK BROS. CO., INC. • OLEAN, NEW YORK

Birmingham, Ala. • Boston • Chicago • Detroit • Houston • Los Angeles New York • Salt Lake City • San Francisco • Tulsa • Washington London • Paris • Bucharest, Roumania • Caracas, Venezuela

Clark Bros. Co., Inc., Olean, New York
Please send information on
- ☐ Axial Flow Compressor
- ☐ Centrifugal Compressor
- ☐ Electric-Driven Reciprocating Compressor
- ☐ Electric-Driven Soot Blower

Name.....
Company.....
Address.....

CLARK

ONE OF THE DRESSER INDUSTRIES

A SUPERIOR VALVE STEM PACKING

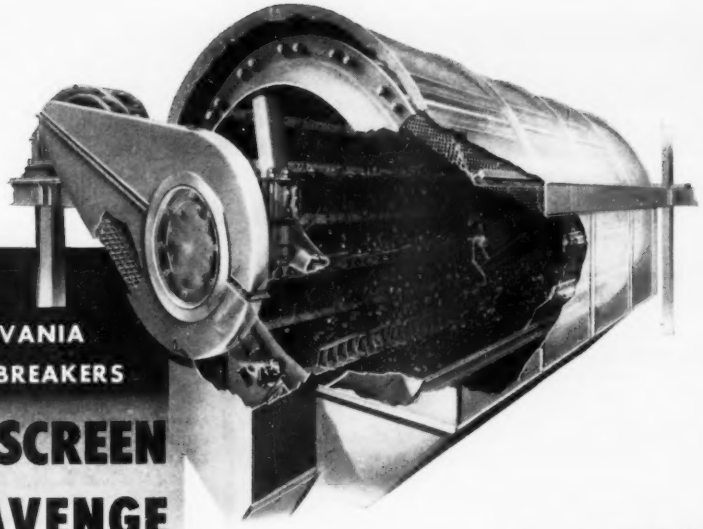
GARLOCK 117—furnished either braided or twisted in all sizes from 1/16" to 3/4", packaged in 1-lb., 2-lb. or 5-lb. spools.

Lasts Longer... Lowers Maintenance Costs!

GARLOCK 117 Valve Stem Packing is manufactured from long fibre asbestos yarn and lubricated with a special heat-resisting compound. Quality controlled from raw material to finished product, GARLOCK 117 gives superior service on all types of valves operating against steam, hot or cold water, or oil. It's economical!

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

Garlock 117



PENNSYLVANIA
BRADFORD BREAKERS

CRUSH, SCREEN and SCAVENGE

ALL IN *One* OPERATION!

More than 65% of all Pennsylvania Bradfords in central station service are single units (the multiple units are usually installed for capacity reasons).

This fact signifies the flexibility, scope and dependability of these units, and also indicates economy of investment and operation for the power plant. Because it is a dependable scavenger, the Pennsylvania Bradford protects stokers, pulverizers and conveyors from tramp iron and other mine refuse. It has the flexibility to handle rail, tidewater and storage coals—soft, medium and hard; wet, dry or frozen—from all sources, at all seasons of the year.

May we send you more information about Pennsylvania Crushers?

PENNSYLVANIA CRUSHER COMPANY
PHILADELPHIA
DIVISION OF BATH IRON WORKS CORPORATION

Liberty Trust Bldg., Philadelphia 7, Pa.

New York • Pittsburgh • Chicago • Los Angeles • Birmingham—Associated with Fraser & Chalmers Engineering Works, London

Manufacturers of a complete line of crushing equipment • Hammermills • Single Rolls • Bradmills • Jaws • Gyratories • Granulators • Impactors • Bradford Breakers

furnace enclosures engineered like skyscrapers

like a skyscraper . . .
a structural steel framework, independently supported or attached to existing furnace steel.

like a skyscraper . . .
brackets, for tile supports, are fastened to the framework on pre-determined centers.

like a skyscraper . . .
refractories are placed on brackets just like books on shelves.

● For proof of the inherent stability of the Bigelow-Liptak unit suspension principle, study the pictures on the right. Repairs are reduced because only damaged or worn tile need be removed; adjacent areas are untouched as no tile bears more than its own weight. Thus, maintenance costs and down time are cut to an economic minimum.

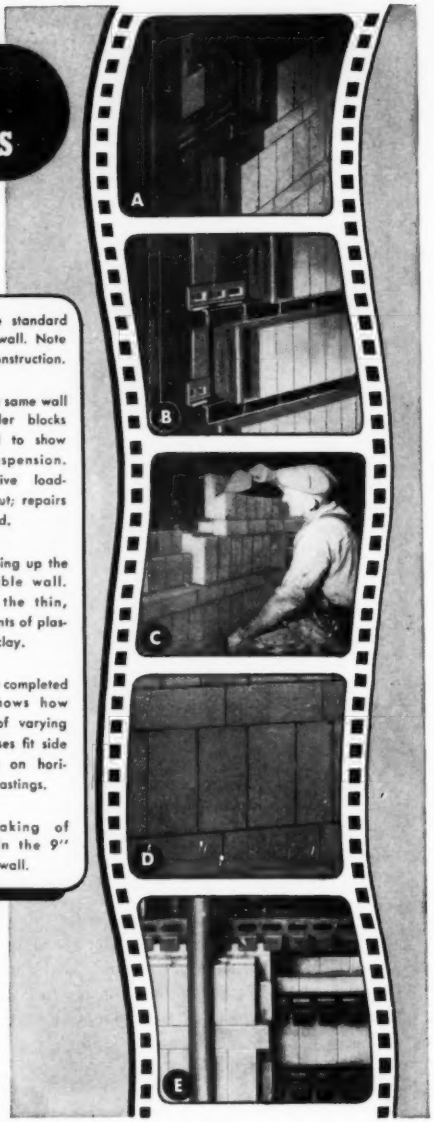
To provide for expansion as well as furnish a sturdy airtight construction, offset joints are thinly buttered with a special plastic fire clay. This clay joint has a drying shrinkage which compensates for tile expansion under operating temperatures.

Bigelow-Liptak enclosures can be applied to any kind of furnace.

Plus Value Features of Suspended Construction

1. Construction is airtight; heat losses are reduced. Maximum efficiency can be maintained and fuel used to full advantage.
2. Enclosures can be built to any dimension or shape. Temperatures govern wall thicknesses.
3. Refractories are easy to replace without disturbing undamaged sections. Maintenance is simple, quick, economical.
4. B-L engineers coordinate enclosure requirements with problems of temperatures, type of firing equipment, and slagging and erosion possibilities.

Write today for more information.



A. The standard 7" B-L wall. Note offset construction.

B. The same wall with filler blocks removed to show unit suspension. Cumulative loading is out; repairs simplified.

C. Laying up the 9" double wall. Notice the thin, even joints of plastic fire clay.

D. The completed wall shows how blocks of varying thicknesses fit side by side on horizontal castings.

E. Breaking of joints in the 9" double wall.

PIONEERS OF SUSPENDED CONSTRUCTION FOR INDUSTRIAL FURNACE ENCLOSURES . . .

BIGELOW LIPTAK Corporation

BIGELOW-LIPTAK

Unit-Suspended Walls & Arches

SUBSIDIARY OF A. P. GREEN FIREBRICK CO.

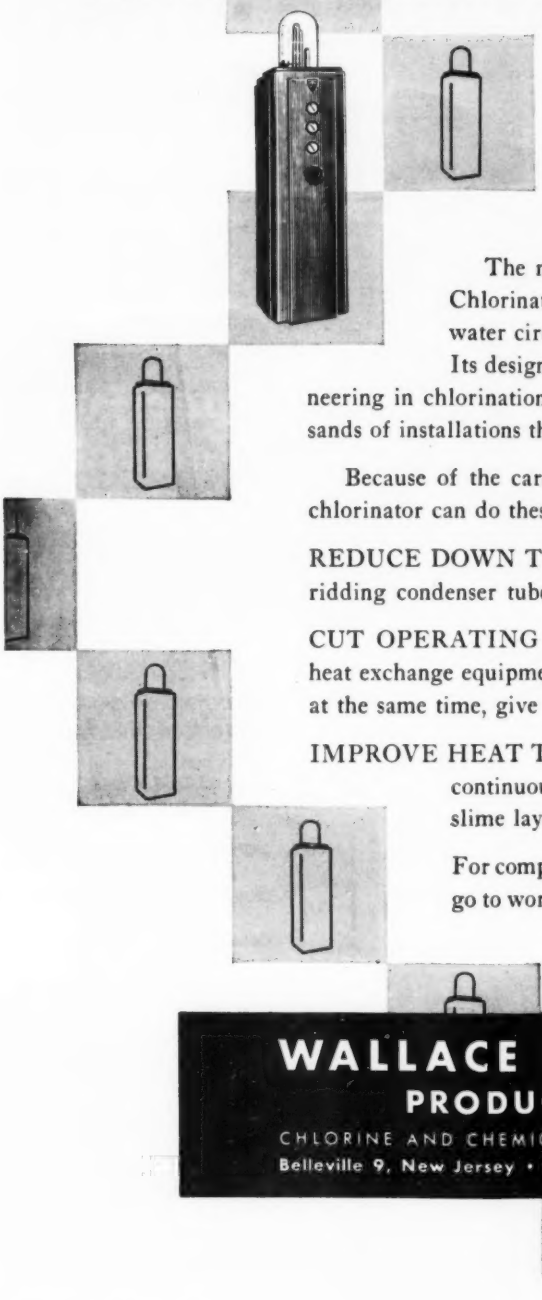
CURTIS BUILDING • DETROIT 2, MICHIGAN

IN CANADA

BIGELOW-LIPTAK OF CANADA, LTD., TORONTO, ONTARIO

DETROIT · CHICAGO · NEW YORK · SEATTLE · SALT LAKE CITY · PHILADELPHIA · MINNEAPOLIS · CLEVELAND · CINCINNATI · PITTSBURGH · SAN FRANCISCO DENVER · OMAHA · KANSAS CITY, MO. · VANCOUVER, B.C. · HOUSTON · ST. LOUIS · ST. PAUL · BUFFALO · ATLANTA · TULSA · BOSTON · LOS ANGELES

FOR YOUR HEAT EXCHANGERS OR CONDENSERS, THIS W&T CHLORINATOR CAN:



- Reduce down time
- Cut operating costs
- Improve heat transfer

The machine shown is a W&T Visible Vacuum Chlorinator for the application of chlorine to cooling water circuits through the W&T De-sliming process. Its design is the result of over thirty-five years of pioneering in chlorination, plus the accumulated experience of thousands of installations throughout the world.

Because of the care put into its design and construction, this chlorinator can do these things economically and dependably:

REDUCE DOWN TIME and eliminate costly plug cleaning by ridding condenser tubes of bacterial-induced slime growths.

CUT OPERATING COSTS by keeping condensers and other heat exchange equipment in service longer without shut-down and, at the same time, give higher operating efficiencies.

IMPROVE HEAT TRANSFER by keeping water-side surfaces continuously protected against the formation of a slime layer.

For complete information on how these advantages can go to work for you, write today. There's no obligation.

WALLACE & TIERNAN
PRODUCTS, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
Belleville 9, New Jersey • Represented in Principal Cities

CD-30

FOR LEAKPROOF, TROUBLE-FREE PIPE RUNS

Cut-a-way view of a Walseal Tee showing ring of silver brazed alloy, and completed Silbraz joint.

Specify Walseal* Products

On all types of piping jobs where Type "B" copper or red brass pipe is used, trouble can be avoided by installing Silbraz* joints — made with Walseal valves, fittings and flanges.

Threadless, patented Silbraz joints are silver brazed (not soft soldered) pipe joints that are leakproof, trouble-free — permanent . . . connections that will not creep or pull apart; that literally join with the piping system to form a "one-piece pipe line". Thus, these modern joints eliminate the need for maintenance and costly repairs — especially important where lowered operating costs are imperative.

For complete details on the modern Silbraz joint, made with Walseal products, write for a copy of Walworth Circular 84.

**Patented — Reg. U. S. Patent Office.*

Recommended for

- **Hot and Cold Water Circulating Systems**
- **Boiler Feed Lines**
- **Steam Return Lines**
- **Condensate Lines**
- **Low and High Pressure Air Systems**
- **Lubricating Oil Circulating Systems**
- **Industrial Gas Piping**
- **Solvent and Vacuum Piping Systems**

Make it a "one-piece pipe line" with WALSEAL

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

This Air Compressor CAN'T BLOW UP...

It's Equipped with a BS&B SAFETY HEAD

The Black, Sivalls & Bryson SAFETY HEAD, containing a rupture disc which bursts at a predetermined pressure, stands sleepless guard over this air pressure system. Whenever overheating, mechanical failure or a faulty control causes a suddenly mounting *over pressure*—a relief valve may not react to it, but the BS&B SAFETY HEAD does! Before the critical point, it bursts . . . and disaster is averted! Investigate this inexpensive protection for *your* property now. Write today to Special Products Division, Black, Sivalls & Bryson, Inc., Power & Light Building, Kansas City 6, Missouri.

Hold-down flange of bolted type SAFETY HEAD assembly—furnished with threaded, welded or flat outlet.

Rupture disc—bursts at a predetermined pressure—guaranteed when sold to burst within 5% of specified pressure.

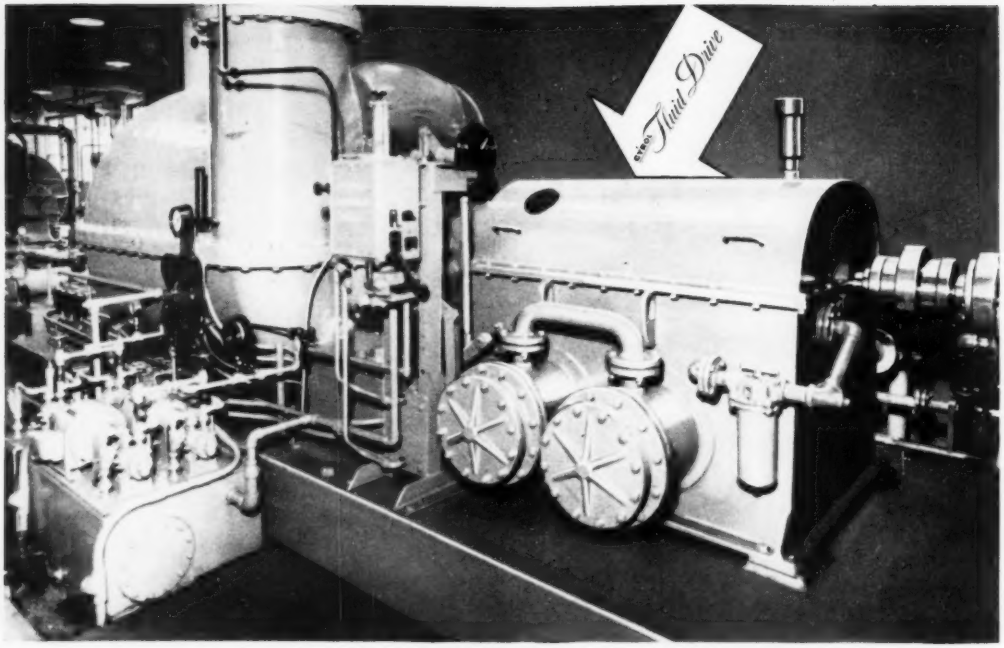
Base flange, bolted type. BS&B SAFETY HEAD flanges can be made to order to suit special conditions. Available with bursting pressures from 5 lbs. to 30,000 lbs.

EFFICIENCY RELIABILITY

FOREIGN INQUIRIES INVITED Cable Address: BLACK, KANSAS CITY, U.S.A.

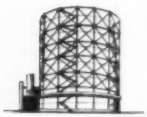
BLACK, SIVALLS & BRYSON, INC.

KANSAS CITY, MO. OKLAHOMA CITY, OKLA.



Type VS, Class 6 Gýrol Fluid Drive attached to gas supply booster.

Gýrol Fluid Drive saves power and protects machinery in gas industry



Maintaining the supply in a gas reservoir is a difficult job.

Gas consumption varies. Yet the pressure inside the reservoir must always remain constant. The gas supply booster, which refills the reservoir, must consequently vary the input to meet these fluctuations.

Here's where Gýrol Fluid Drive comes in.

Attached to the gas supply booster, Gýrol Fluid Drive provides stepless speed control that can be easily and accurately adjusted to keep the pressure up.

The Fluid Drive also allows no-load starting for the 1500 h.p. motor.

The advantages? Substantial savings in power, longer machine life and quieter operation. Power transmission with Gýrol Fluid Drive is completely foolproof, dependable and easy to operate.

Your business

If you're concerned about power transmission in any plant or on products, or, if you want to improve the over-all efficiency of existing processes, investigate the unique advantages of Gýrol Fluid Drive.

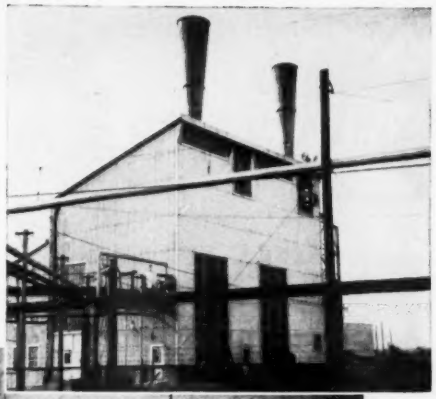
Write today for information on Gýrol Fluid Drive or consult your nearest American Blower Branch Office. There is no obligation.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary corporation

AMERICAN BLOWER
GÝROL *Fluid Drive*

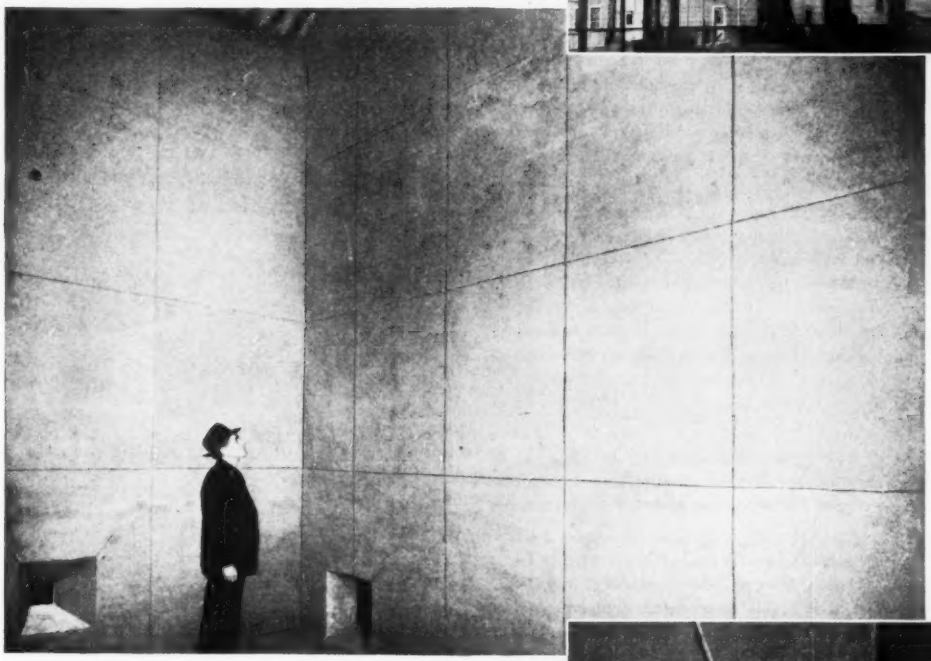
Serving home and industry
AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILER • ROSS HEATER • TONAWANDA IRON

Air-cooled lining for 800 h. p. boiler completely replaced in two weeks!



At the Lake Road Steam Plant of the St. Joseph Light & Power Co., St. Joseph, Mo., Boiler No. 1 required relining — in a hurry. It's an 800 h.p. Walsh & Weidner boiler equipped with combination gas and oil burners and regularly operating at 400% of rating. With the heavy winter load almost upon the utility, the original tile lining was approaching collapse.

The Plibrico sectionally-supported, air-cooled wall was the answer. In exactly two weeks from furnace inspection to firing, the original lining was replaced with Plibrico construction including all necessary engineering.



In one day, right on the job, our engineer drafted the entire steel layout and all construction details. This speed is possible because of Plibrico simplicity. The Plibrico refractory materials were shipped that same day including the required anchors and fittings. Within one week, the old lining was removed, the new steel fabricated and erected. In five days, the new air-cooled lining of Plibrico *Super* (shown above) was installed. In exactly two weeks, the boiler was again producing steam at normal capacity.

Plibrico offers you not only the speed of installation that comes with extreme adaptability but also the greater durability and economy of monolithic construction. Plibrico distributors in principal industrial centers maintain the most complete installation and boiler setting service in America. Call in your local Plibrico Sales & Service engineer or write for catalog, specifying water tube or H.R.T. boiler edition.

Plibrico engineer points out construction features to E. E. Wilson, Chief Engineer, St. Joseph Light & Power Co., St. Joseph, Mo.

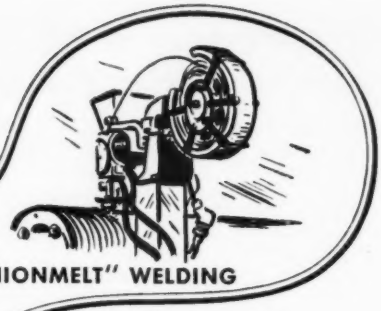
PLIBRICO JOINTLESS FIREBRICK COMPANY, 1818 Kingsbury St., (Dept. B), Chicago 14, Ill.

PLIBRICO *Air Cooled* WALLS

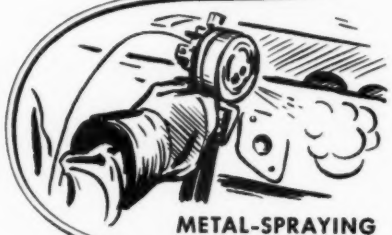
HASTELLOY Alloy Wire

TRADE-MARK

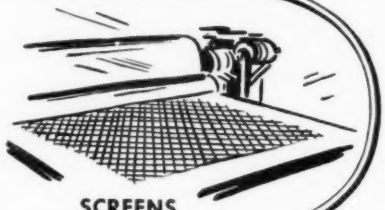
FOR METAL-SPRAYING, WELDING, and FABRICATED WIRE PRODUCTS



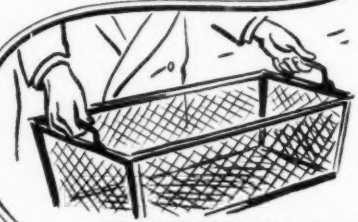
"UNIONMELT" WELDING



METAL-SPRAYING



SCREENS



HEAT-TREATING BASKETS

HASTELLOY nickel-base alloys, in the form of drawn wire, are available for the fabrication of corrosion-resistant screen, cloth, and baskets. The wire is also excellent for metal-spraying and for many types of automatic welding and hard-facing.

HASTELLOY alloys have a tensile strength comparable to that of the high-strength alloy steels, and possess unusual strength even at elevated temperatures. These alloys are specially designed to withstand the most severe conditions of chemical corrosion. Nickel-molybdenum alloy B is particularly resistant to hydrochloric and sulphuric acids, many organic acids, and all alkalies. Alloy C, a nickel-molybdenum-chromium-tungsten-iron composition, has excellent resistance to strong oxidizing agents, such as ferric chloride and wet chlorine, and is outstanding in its resistance to brine and salt spray.

In addition to HASTELLOY alloy wire, you can also obtain wire made of MULTIMET alloy—a cobalt-chromium-nickel composition developed for service at elevated temperatures.

Cut and straightened lengths or coils, in diameters down to 0.060 in., can be obtained directly from Haynes Stellite Company, Kokomo, Indiana. Wire in diameters less than 0.060 in. down to 0.002 in. is available from an associate company, Kemet Laboratories Company, Inc., Madison Avenue and West 117th Street, Cleveland 1, Ohio. For more complete information, write for a copy of the booklet, "HASTELLOY High-Strength, Nickel-Base, Corrosion-Resistant Alloys."

HAYNES Alloys

TRADE-MARK

Haynes Stellite Company

Unit of Union Carbide and Carbon Corporation

UCC

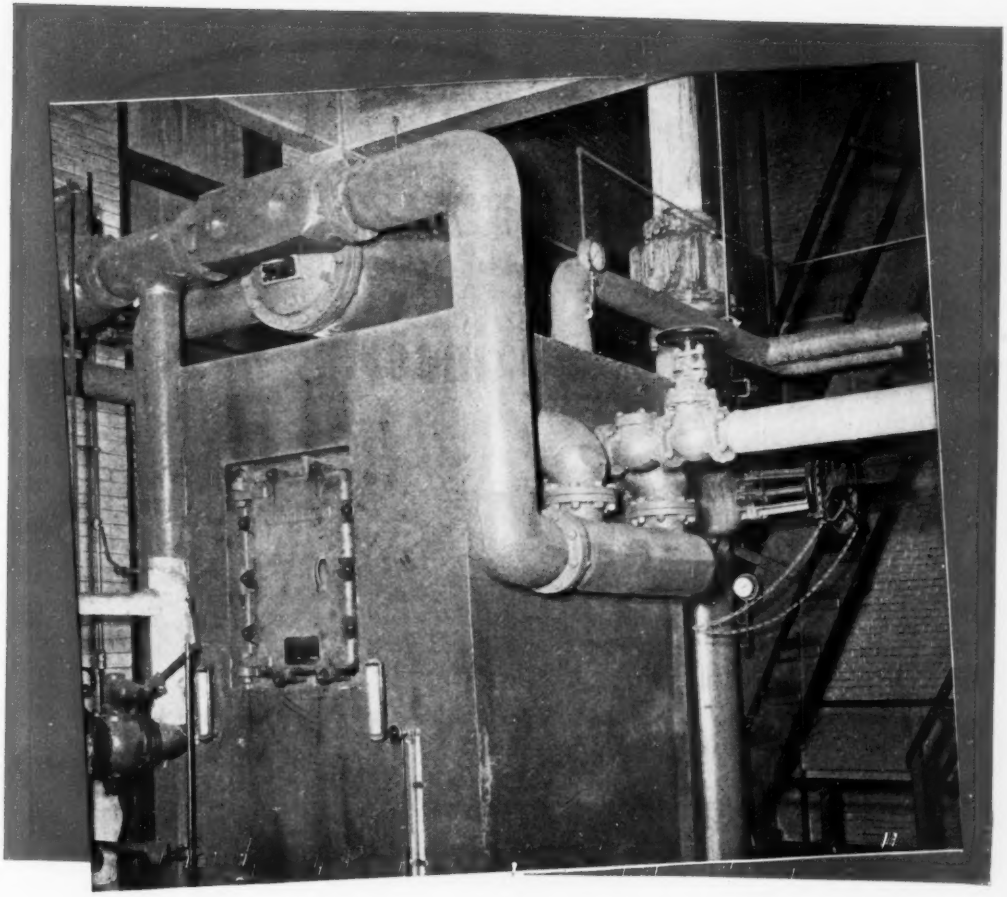
General Offices and Works, Kokomo, Indiana

Sales Offices

Chicago—Cleveland—Detroit—Houston

Los Angeles—New York—San Francisco—Tulsa

The terms "Haynes," "Hastelloy," "Multimet" and "Unionmelt" are trade-marks of Units of Union Carbide and Carbon Corporation.



Welded power piping at International Harvester.

Piping plays a vital part . . .

IN the power plant of the International Harvester operation at Louisville, Ky., this Cochrane Deaerating Heater works smoothly and effectively with modern boilers. Thanks to Tube-Turn welding fittings, its piping system is permanently leakproof . . . a fact that assures uninterrupted service for the life of the system.

Thousands of power plants all over the country rely on the many vitally important advantages that only welded piping can provide. And, in a host of installations like that of International Harvester, Tube-Turn welding fittings and flanges are an integral part of strong, safe piping that insures years of efficient, trouble-free performance.

Behind the trade name "Tube-Turn" stands the nation's No. 1 welding fittings manufacturing experience. That's why, for good service in good connections, it pays to deal with a Tube Turns distributor.

TUBE TURNS, INC.
236 E. Broadway, Dept. E, Louisville 1, Ky.
District Offices at New York, Philadelphia, Pittsburgh, Chicago, Houston, Tulsa, San Francisco, Los Angeles

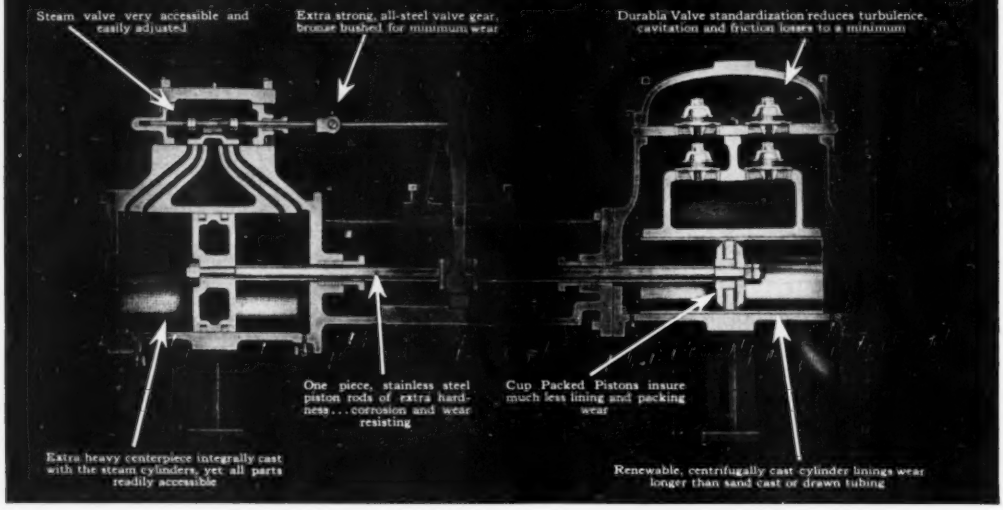
TUBE-TURN
tt
WELDING FITTINGS AND FLANGES

Write for folder, "Dimensional Data and Weights of Tube-Turn Welding Fittings." Opens to series of quick-reference tables.

A TYPICAL EXAMPLE OF

Superior Pump Engineering

WARREN REALWEAR STEAM PUMP


Steam valve very accessible and easily adjusted
Extra strong, all-steel valve gear, bronze bushed for minimum wear
Durabla Valve standardization reduces turbulence, cavitation and friction losses to a minimum
One piece, stainless steel piston rods of extra hardness... corrosion and wear resisting
Cup Packed Pistons insure much less lining and packing wear
Extra heavy centerpiece integrally cast with the steam cylinders, yet all parts readily accessible
Renewable, centrifugally cast cylinder linings wear longer than sand cast or drawn tubing

THE Warren "Realwear" is an example of engineering from *your* viewpoint. Notice the plus features in the cutaway view above. Compare with any similar make.

This is the type of engineering that goes into *every* Warren pump—both reciprocating and centrifugal. Dependability, maintained efficiency with low maintenance costs are first considerations. Let us talk with you about your next pumping problem. Write:

WARREN STEAM PUMP COMPANY, INC.
Warren, Massachusetts

Atlanta Boston Chicago Cleveland Denver Detroit Houston
Manchester, Conn. Los Angeles Minneapolis New Orleans New York
Philadelphia Pittsburgh Richmond San Francisco Seattle St. Louis

Warren Pumps

CENTRIFUGAL AND RECIPROCATING

P-10

*Water Treatment?
You Bet!

THE BIRD-ARCHER 8-POINT WATER TREATMENT SERVICE

All or any part of this service is available to you

1. *Study of all available water sources*
2. *Plant survey*
3. *Laboratory Service for scientific analysis*
4. *Development of treatment and control systems*
5. *Instructing plant staff in the operation and control of the treatment system*
6. *Furnishing properly prepared treatment materials*
7. *Specifying any equipment necessary*
8. *Regular check-ups by service engineers*

Babu, the elephant's mahout, takes good care of his mobile power plant. After lugging logs and timber through the forest all day, his elephant gets a complete water treatment at the river. His feet are kept free of *scale* and *dirt*. He's rubbed and scrubbed . . . given the best of care because that's the best way to get work out of an elephant.

The best way to keep water and steam handling equipment at peak efficiency is with the aid of Bird-Archer water treatment. More than 60 years of experience lie behind Bird-Archer methods for combating scale and corrosion. The results in thousands of cases . . . lower operating costs, increased efficiency, longer equipment life.

Bird-Archer offers a complete 8-point service — all or any part of which is available to you. Put a note on your pad now to discuss your specific problems with a Bird-Archer field engineer.

BA-139

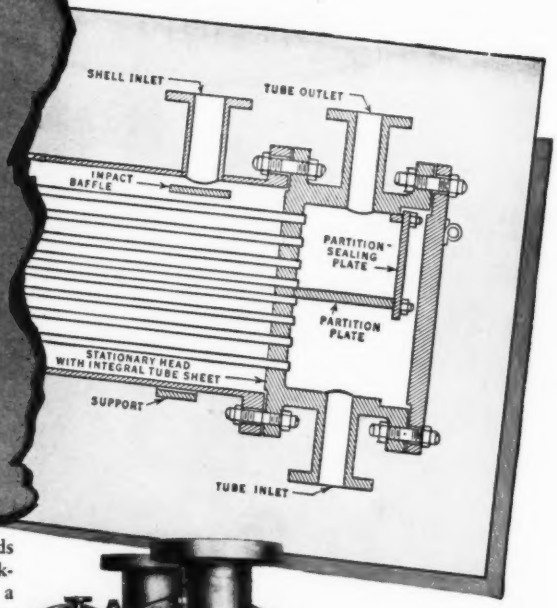
BIRD·ARCHER

THE BIRD-ARCHER COMPANY, 400 MADISON AVE., NEW YORK 17, N. Y.

Philadelphia, Pennsylvania • Chicago, Illinois • Montreal, Canada

CALDERAS Y ACCESORIOS, S. A. AMSTERDAM 291, MEXICO, D. F.

Leakage Between Passes Prevented in G-R FEEDWATER HEATER



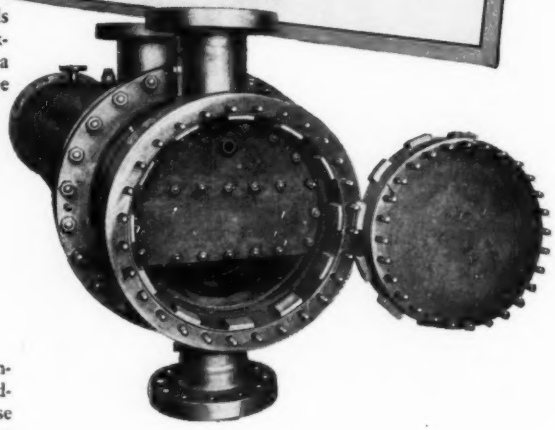
The partitions between passes in the water heads of feedwater heaters are a fruitful source of leakage that can't be detected. The head cover is a literal "iron curtain" behind which you can't see short-circuiting of water between passes.

●

Griscom-Russell offers designs of feedwater heater stationary and floating heads in which this inter-pass leakage CAN'T occur. How? By making the differential in water pressure between the passes help to keep the partition joints *tight* instead of tending to force them apart.

●

The sketches tell the story. It's one of many instances of G-R pioneering in the design of feedwater heaters. Write for bulletin describing these heaters and their many distinctive features that give you benefits you can't obtain in other feedwater heater designs.



THE GRISCOM-RUSSELL CO.
285 MADISON AVENUE, NEW YORK 17, N. Y.

GR-201

GRISCOM-RUSSELL

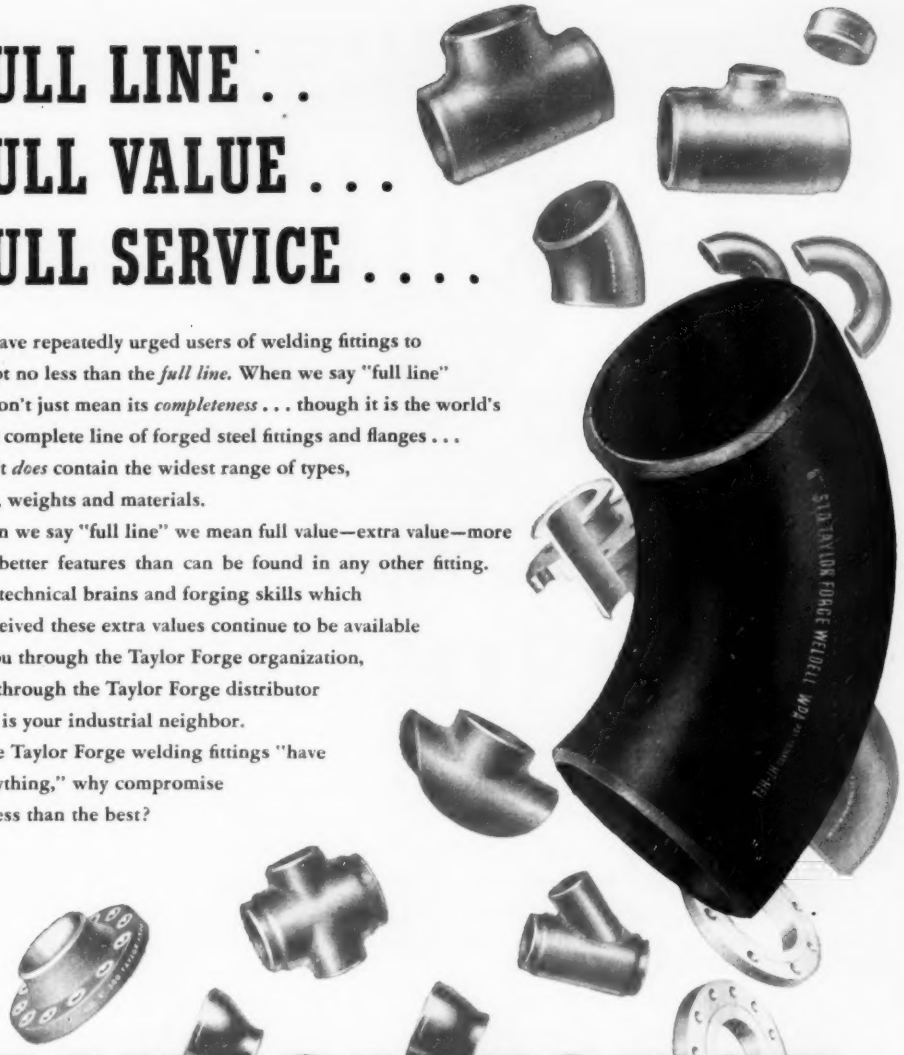
Pioneers in Heat Transfer Apparatus

FULL LINE . .
FULL VALUE . . .
FULL SERVICE . . . .

We have repeatedly urged users of welding fittings to accept no less than the *full line.* When we say "full line" we don't just mean its *completeness* . . . though it is the world's most complete line of forged steel fittings and flanges . . . and it *does* contain the widest range of types, sizes, weights and materials.

When we say "full line" we mean full value—extra value—more and better features than can be found in any other fitting. The technical brains and forging skills which conceived these extra values continue to be available to you through the Taylor Forge organization, and through the Taylor Forge distributor who is your industrial neighbor.

Since Taylor Forge welding fittings "have everything," why compromise on less than the best?



TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS General Offices & Works: Chicago 90, Ill. (P.O. Box 485) Eastern Plant: Carnegie, Pa. Western Plant: Fontana, Calif. • District Offices—New York: 50 Church Street • Philadelphia: Broad Street Station Bldg. • Pittsburgh: First National Bank Bldg. • Chicago District Sales: 208 S. LaSalle Street • Houston: City National Bank Bldg. • Los Angeles: Subway Terminal Bldg.

Do your piping systems create any fitting or flange problems for you? . . . . . If the information you need goes beyond the simple return of the coupon at the right, please write us fully. You will receive a prompt and detailed reply.

☐ Who is my nearest Taylor Forge Distributor?

☐ Put my name on your mailing list to receive informative literature.

Name_____

Position_____

Company_____

Street Address_____

City_____ Zone____ State_____

501-0249 Mail to Taylor Forge & Pipe Works, P.O. Box 485, Chicago 90, Illinois

LONDON and BIRMINGHAM

BRITISH INDUSTRIES FAIR

Britain has long been the world's greatest customer, and has led the way in the export of manufactured products. By initiative in modern research, and from experience of commerce with other nations, her industrial production has become greater and more varied than ever in history.

Renowned for the quality of her work, Britain has applied new technique to her famous industries. By enterprise in fresh markets she has achieved record deliveries, and export production still expands. To keep in touch with these developments great numbers of the world's principal buyers are making visits to Britain.

Every year, from over 100 countries, trade buyers gather at the British Industries Fair. The Chamber of Commerce in Birmingham, and manufacturers from every part of Britain, join with the British Government to welcome them.

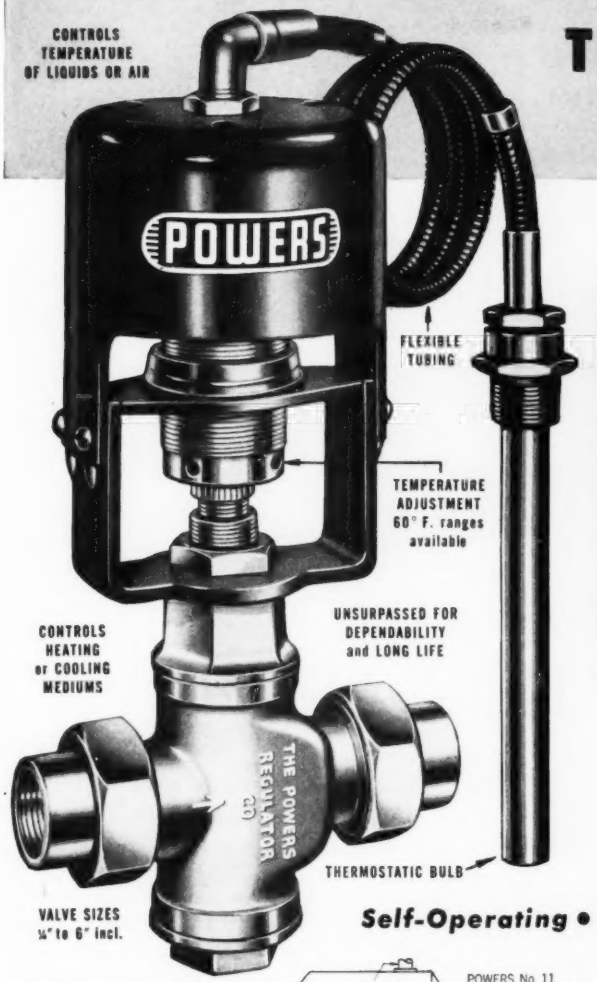
At BIF 1949, from 2–13 May, three thousand exhibitors will display the latest developments in thirty groups of allied trades. The leading men of international commerce are invited to attend the world's greatest assembly of national products.

2-13 MAY 1949

TRADE BUYERS—PLAN YOUR VISIT NOW

Information about exhibitors, special displays and facilities at the Fair can be obtained from the nearest British Embassy, Legation or Consulate.

When You Want LOW COST TEMPERATURE CONTROL


CONTROLS TEMPERATURE OF LIQUIDS OR AIR
POWERS
FLEXIBLE TUBING
TEMPERATURE ADJUSTMENT 60° F. ranges available
UNSURPASSED FOR DEPENDABILITY and LONG LIFE
CONTROLS HEATING or COOLING MEDIUMS
THE POWERS REGULATOR CO.
THERMOSTATIC BULB
VALVE SIZES ¼" to 6" incl.

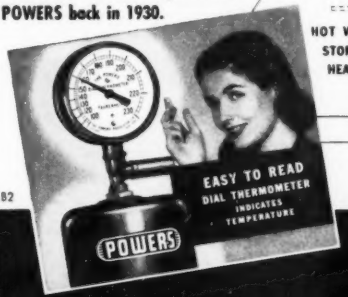
for

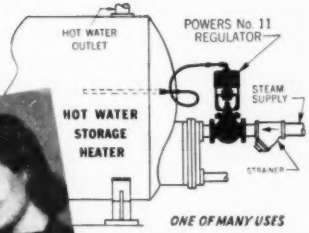
- WATER HEATERS
- INDUSTRIAL PROCESSES
  Vats • Tanks • Dryers • Kettles
- FUEL AND CRUDE OIL HEATERS
- DIESEL ENGINE COOLING
- BOTTLE AND CAN WASHERS
- METAL PARTS WASHERS • DEGREASERS
- Dishwashers • Steam Tables • Coffee Urns
- DRYING ROOMS • COLD STORAGE ROOMS

Use POWERS No. 11 REGULATORS

Self-Operating • Easy To Install • Economical

Regulator can be supplied with Dial Thermometer—a feature pioneered by POWERS back in 1930.





ONE OF MANY USES

SIMPLIFY your temperature control problems with Powers No. 11 Regulators. They prevent over-heating—save steam and labor—often give 10 to 25 years of dependable control and pay back their cost several times a year. Just the regulator for many applications requiring a constant temperature.

• *Phone or write our nearest office for Bulletin 329 and prices.*

1182

CHICAGO 14, ILL., 2720 Greenview Ave. • NEW YORK 17, N. Y., 231 East 46th Street
LOS ANGELES 5, CAL., 1808 West Eighth Street • TORONTO, ONT., 195 Spadina Ave.

THE POWERS REGULATOR CO.

OFFICES IN 50 CITIES • SEE YOUR PHONE BOOK

Over 55 Years of Temperature and Humidity Control

"Believe it or not . . . this is my COMPLETE V-Belt Inventory"

"WE used to stock 124 different sizes of endless V-belts. Now, just four reels of Veelos, the link V-belt, give us every size we need. The right length belt for any drive is uncoupled from a reel, quickly made endless, then installed. Machine downtime for belt changeover is almost eliminated by the ease with which matched sets of any required length can be coupled on a drive. And by switching to Veelos, we've made a big saving on our V-belt investment."

You can do the same.

4 reels of Veelos provide as many as 316 sizes of endless V-Belts

Very likely you need less than 316 sizes for a complete V-belt inventory. When you stock Veelos on reels you can forget belt deterioration and obsolescence. Storage space is saved. Inventory records are simplified.

Veelos is made in all standard sizes . . . fits all standard grooves . . . is available in 100 foot reels. Sales engineers in principal cities; over 300 distributors throughout the country.

VEELOS
THE LINK
V-BELT

NEW VEELOS CATALOG

This is the catalog that brings many V-belt benefits to you. It gives you all the facts and complete engineering data. Your copy sent on request.

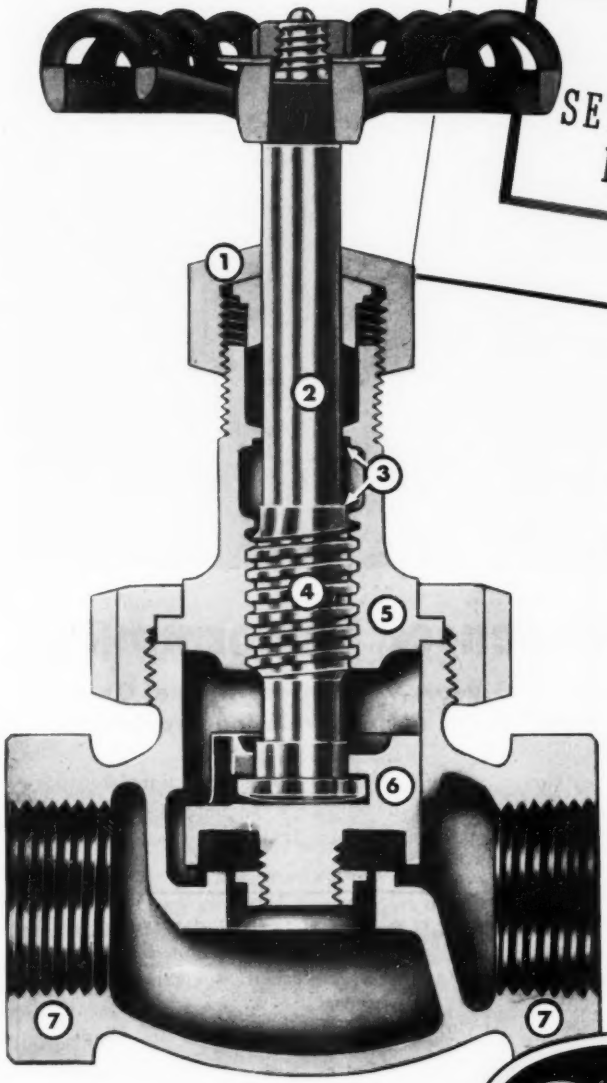
MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PENNSYLVANIA

VEELOS is known as VEELINK outside of the United States

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

COST REDUCING *extras...*

OIC SETS THE PACE IN VALVES



1 The extra large packing nut will stand a man-sized wrench and has sufficient threads to utilize all packing in the stuffing box.

2 Heavy, wear-resisting manganese bronze stem means longer wear with less maintenance.

3 Back seating, providing special seat surface on stem above threads, permits quick, easy repacking under pressure.

4 Large thread contact area withstands extraordinary strain and maintains tight closure.

5 Sturdy bronze bonnet, union type construction, assures a tight bonnet joint and permits quicker and easier inspection and servicing.

6 Slip-on type disc holder is designed especially to permit quick, easy replacement.

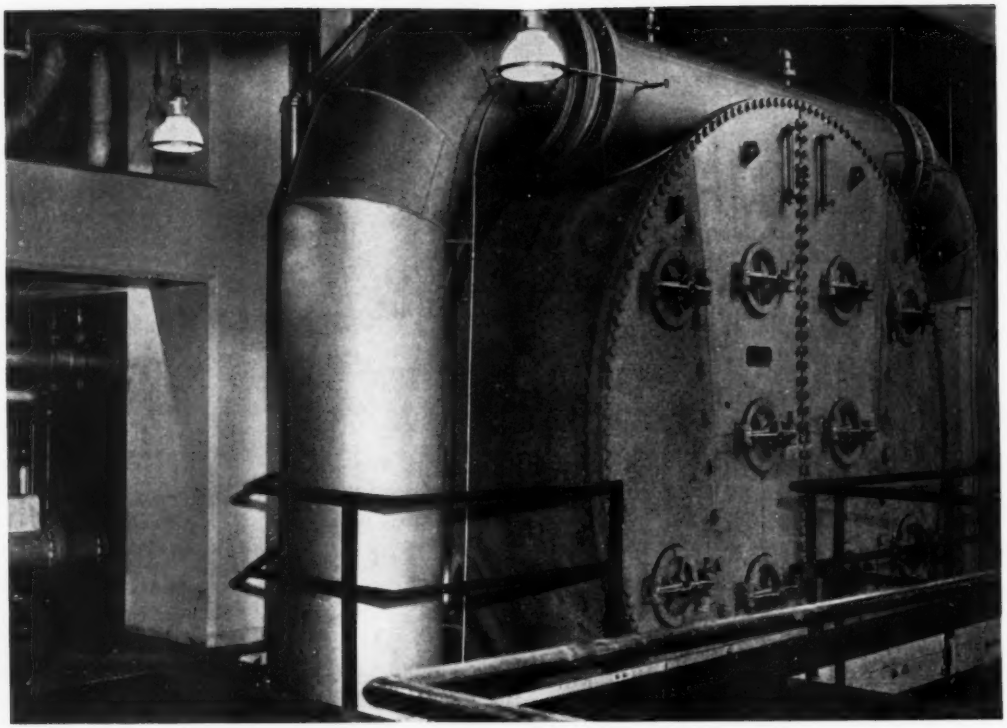
7 Heavier, better construction throughout the distortion-proof body provides maximum resistance to operating stresses. Full area water ways throughout. Adequate stock for repeated re-seating.

NO MORE CHANGE-OVER TROUBLES WITH THE HANDY OIC CROSS REFERENCE CHART
Just check the number of the valve that you wish to replace, look in the OIC Cross Reference Chart, and you will find the number of the OIC Valve to replace it. For your free copy, write to The Ohio Injector Company, Wadsworth, Ohio.

O-188-17

OIC VALVES

STEEL • IRON • BRONZE



How's this for Condenser Performance?

Lummus unit serves Ohio Edison for 5 years without down-time. Oxygen content of condensate tests "zero" daily, despite wide load variation.

This surface condenser is part of a Lummus heat exchanger system installed early in 1944 in the Gorge Power Station of the Ohio Edison Company, Akron.

The unit has a deaerating-type hotwell of Lummus design. Deaeration has been constant, over loads varying from 25% to a normal maximum of 45,000 kw. The condensate has been tested every shift for oxygen content. Throughout the five-year run, the readings have fallen consistently within what our customer's engineers consider "zero"—a maximum of .005 cc per liter!

No overhauling requiring a shutdown has been necessary during this period.

For heat exchanger equipment that will perform as you want it to — with minimum maintenance — see that the job goes to Lummus. Complete information is available from our nearest office.

THE LUMMUS COMPANY
Heat Exchanger Division
259 West 14th Street, New York 11, N. Y.

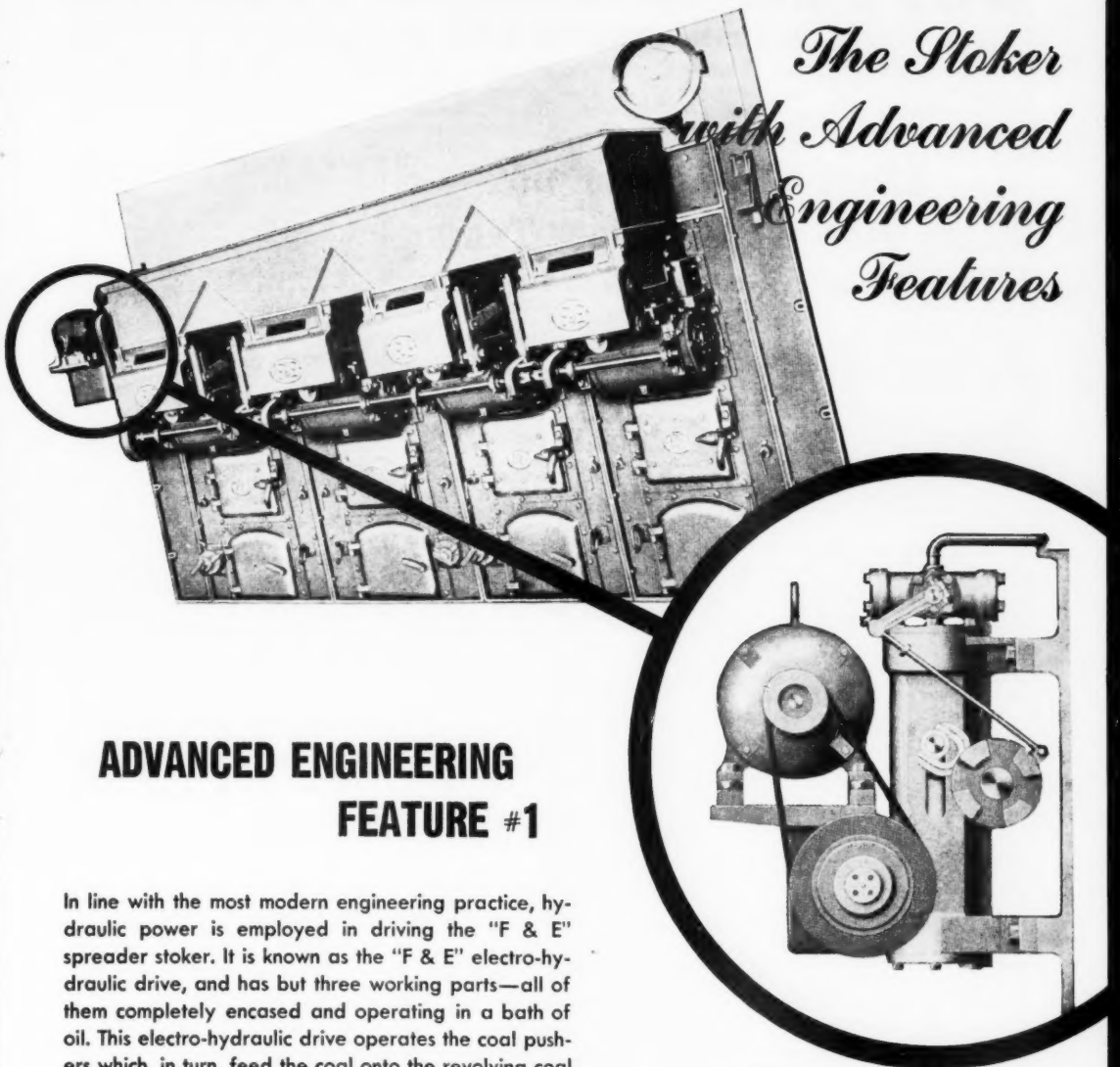
LUMMUS

Atlanta • Boston • Chicago • Cleveland • Corpus Christi
Detroit • Houston • Fort Worth • Philadelphia • Pittsburgh
Minneapolis • Rochester • St. Louis • San Francisco
Buenos Aires • Honolulu • Manila • San Juan, P. R.

LOOK TO LUMMUS for Heat Exchangers • Process Condensers • Reboilers • Steam Generators • Steam Jet Refrigeration Steam Surface Condensers • Barometric Condensers • Steam Jet Air Ejectors • Evaporators • Boiler Blowdown Heat Exchangers Fuel Oil Heaters • Lubricating Oil Coolers • Pipe Line Coolers • Feed Water Heaters • Jacket Water Coolers

THE F&E SPREADER STOKER

The Stoker with Advanced Engineering Features



ADVANCED ENGINEERING FEATURE #1

In line with the most modern engineering practice, hydraulic power is employed in driving the "F & E" spreader stoker. It is known as the "F & E" electro-hydraulic drive, and has but three working parts—all of them completely encased and operating in a bath of oil. This electro-hydraulic drive operates the coal pushers which, in turn, feed the coal onto the revolving coal distributors. Any rate of coal feed from zero to maximum obtainable. ACCESSIBILITY, SIMPLICITY AND DURABILITY describe the "F & E" electro-hydraulic drive.

The same electric motor which supplies hydraulic power for the feeding of the coal also supplies the power to the revolving coal distributors.

This is the first in a series of advertisements illustrating the advanced engineering features of the "F & E" Spreader Stoker. For a complete description, write and ask for bulletin #1301.

F&E FLYNN & EMRICH COMPANY

HOLLIDAY & SARATOGA STS. ESTABLISHED 1842 BALTIMORE 2, MARYLAND

THE STOKER THAT WAS A SENSATION AT THE 1948 POWER SHOW

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Effect of Ammonia on Steam Side of Condenser Tubing

How Season Cracking Has Been Eliminated

Occasionally season cracking of condenser tubes has been encountered in power plants when traces of nitrogen compounds, present in the boiler water, decompose with liberation of ammonia, which finally finds its way into the condenser. The practice today in many power plants is to use deaerators or evaporators for removing impurities and gases from the boiler water, and jet condensers for removing ammonia and other non-condensable gases from the condenser. Both help to reduce the concentration of ammonia.

Nature of Season Cracking

Conditions which lead to season cracking are well understood. This type of failure is neither confined to one kind of material nor to one kind of corrosive medium. For example, carbon steel is affected by certain caustic solutions; stainless steel by acid chlorides; aluminum and magnesium by sea water; brass by ammonia; plastics by certain solvents; rubber by oxidation, etc.

It has long been known that susceptible *hard-drawn* brass exposed to the *combined* action of *ammonia, water vapor* and *air* over a period of *time* will season crack. This type of failure was more common many years ago, when it was standard practice to supply brass condenser tubing in the hard-drawn condition. Quite frequently these hard-drawn brass tubes cracked longitudinally, due to the presence of high residual stresses resulting from cold working the metal.

Annealing to Eliminate Season Cracking

When it was recognized that residual stresses in brass would lead to season cracking, steps were taken by condenser tube manufacturers to assure the removal of such stresses from the tubes by annealing. Tubes were heated to various temperatures for certain lengths of time depending upon the alloy and the extent of cold working. Later, recognition of the value of an anneal led to its inclusion in A.S.T.M. Specification B-111 for Copper Alloy Condenser Tubes. This calls for the annealing of condenser tubes to produce grain sizes within a specified range, and requires that they pass the mercurous nitrate test without cracking.

Mercurous Nitrate Test

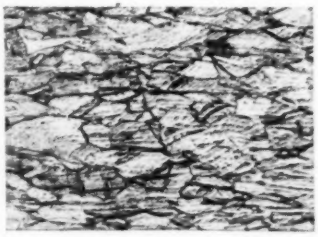
This test, involving the immersion of brass tubes in mercurous nitrate solution, reveals the presence of residual stresses by producing cracking within a few minutes. The salt reacts with the metal, forming a layer of liquid mercury which penetrates the highly stressed metal along the grain boundaries. In 1941 this procedure was officially adopted by the A.S.T.M. and is described in the "Standard Method of Mercurous Nitrate Test B-154" as found in the 1946 Book of A.S.T.M. Methods of Chemical Analysis of Metals. Of course, condenser tubing in actual service would never be subjected to conditions approaching the severity of the mercurous nitrate test.

Effect of Alloy Composition

Copper-base alloys vary in their behavior toward ammonia and liquid mercury. Laboratory tests have shown the absence of season cracking of hard-drawn copper when immersed in ammonium hydroxide. A.S.T.M. Specification B-111 does not require the mercurous nitrate test for Copper, Arsenical Copper, or Cupro Nickel condenser tubing.

Wherever conditions are encountered which may lead to season cracking, a precaution, in addition to using annealed tubing, consists of specifying those alloys which show a maximum resistance to season cracking. These are Deoxidized Copper, Phosphorized Copper, and Cupro Nickel. Materials such as Aluminum Bronze and Red Brass are generally considered as occupying a position between the above-mentioned alloys and more susceptible alloys, such as hard-drawn Admiralty, Aluminum Brass and Muntz Metal. It is, of course, standard practice at Bridgeport to anneal all condenser tubes except hard-drawn copper, which is used by some inland power plants. All Bridgeport condenser tubing must pass such A.S.T.M. requirements as the expansion test, flattening test, hydrostatic test, mercurous nitrate test, and grain size control, as well as other special tests which may be required by customers.

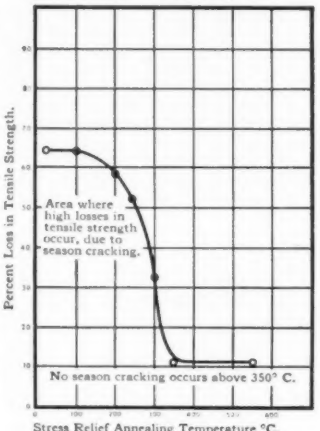
This discussion does not cover the effect of stresses which may be set up through handling, storage, and installation of condenser tubing. These will be the subject of a subsequent article.



Micrograph of longitudinal section of hard-drawn 70-30 Cupro Nickel tubing, showing absence of season cracking after exposure to ammonium hydroxide vapor. 210X.

Fig. 1—Effect of stress relief annealing temperature on season cracking.

(Alternate immersion of 50% hard Leaded Brass Tubing in 15 normal ammonium hydroxide solution.)


Percent Loss in Tensile Strength.
Area where high losses in tensile strength occur, due to season cracking.
No season cracking occurs above 350° C.
Stress Relief Annealing Temperature °C.
(1 hour anneals)

Bridgeport's Laboratory Helpful

Power plant engineers should avail themselves of Bridgeport's long experience with condenser and heat exchanger tube problems. Corrosion research is an important function of Bridgeport's laboratory. A study of the present condition of your condenser tubes may be helpful in selecting the alloy which will give you best service life when you are ready to retube or install new additional equipment.

Write for your copy of Bridgeport's Condenser Tube Manual. It is a compact reference on tubes used for condensers, heat exchangers and evaporators used in power plants, ships and process industries. Considerable space is given to the results of research and study of corrosion. Contact the nearest Bridgeport office for service.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • *ESTABLISHED 1865*

Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal

PETROLEUM PROCESSING SPEEDED WITH WICKES TYPE-A STEAM GENERATORS

Profitable processing of crude petroleum into fine oils and fuels requires the most efficient equipment available. These three Wickes Type-A water tube steam generators are operating in an oil field near Delhi, Louisiana. Wickes Package Type-A Steam Generators are compactly designed and efficiently engineered for immediate installation with least possible erection problems. Units are designed for pressures up to 850 psi, producing up to 200,000 lbs. steam per hour. Write for descriptive catalog.

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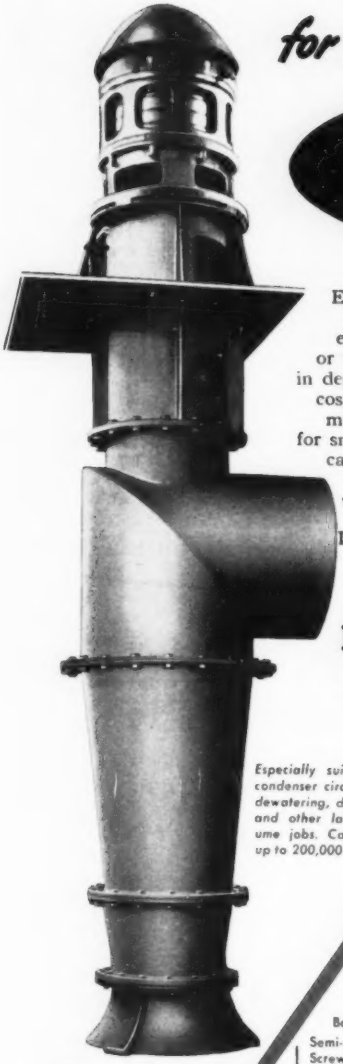
Economy
AXIAL FLOW PUMPS



For low-head, large volume pumping, Economy axial Flow Pumps are unsurpassed by any other type of efficient pumping equipment. Designed for either horizontal or vertical settings, these pumps are simple in design, compact in construction, and low in cost. Axial Flow propellers are accurately machined, hand finished all over balanced for smooth, trouble-free operation. Pumps can be furnished with oil or grease lubricated metallic bearings or water lubricated rubber bearings. For complete details write Dept. BC-2 for Bulletin G-845.

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Centrifugal, axial, and mixed flow pumps for all applications.

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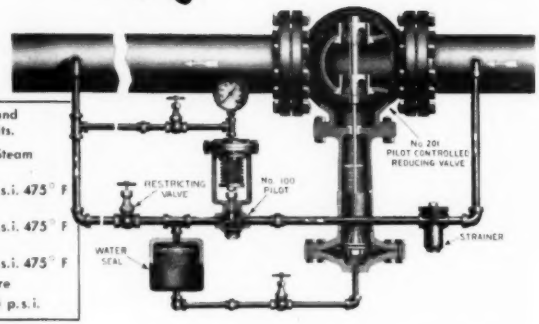
FOR HEAVY-DUTY STEAM REGULATION

Klipfel No. 201 VALVE



Initial pressure and temperature limits.	
Body	Steam
Semi-steel Screwed	200 p.s.i. 475° F
Semi-steel 125 lb. flanges	125 p.s.i. 475° F
Semi-steel 250 lb. flanges	250 p.s.i. 475° F
Reduced Pressure	
For all sizes, 10-125 p.s.i.	

A pilot controlled, double disc reducing valve, the Klipfel No. 201 is especially suited for close regulation on heavy duty steam service. Equipped with balanced inner valve and renewable seats. Rubber diaphragm protected by water seals top and bottom. Pilot valve has metal diaphragm for reduced pressure above 75 p.s.i. Semi-steel bodies with monel or stainless steel trim.

For complete details write Dept. BC-2 for Bulletin 148.

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Sprocket chain is essentially an assembly of Sidebars, Bushings, Rollers and Pins, fabricated from Strips, Bars, and Rounds of steel.

Since UNION manufactures all types of steel sprocket chain for the transmission of power and the mechanical handling of materials and **nothing else,** the specifications of every lot of Steel which UNION buys, are determined only by the desire to build the greatest ultimate service into the particular chain part for which it is required. This circumstance should be interesting to UNION'S present and future customers.

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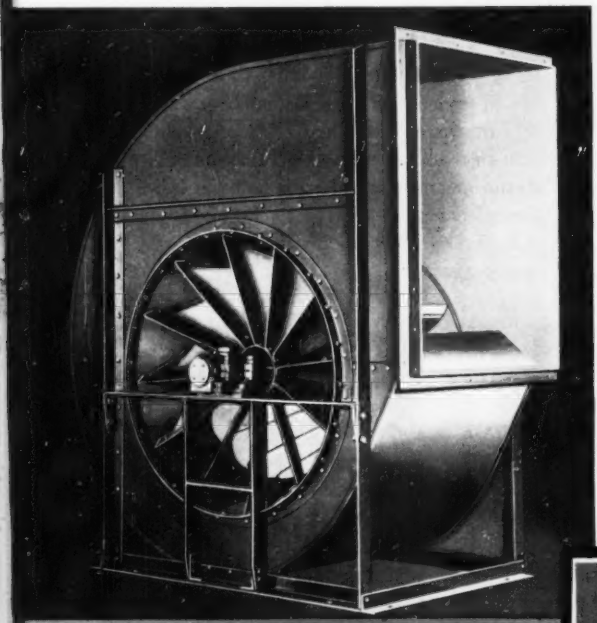

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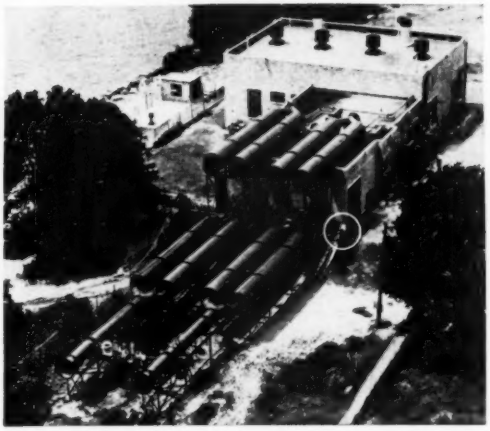

The big Maxim Silencers above (note size of man in circle) quiet the scream of centrifugal compressors on test stands . . . as tough a silencing job as you are likely to find. Maxim engineering solved it and can solve your silencing problems too. Take advantage of Maxim's greater experience when you have silencing to do.

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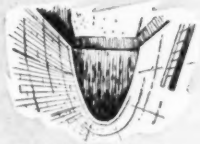
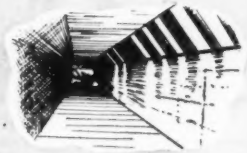
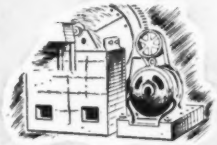
Ash Pit and Cinder Catcher Linings



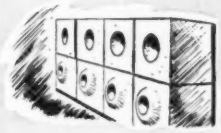
Coal Bunker Linings



Flue and Duct Linings



Overnight Structural Concrete



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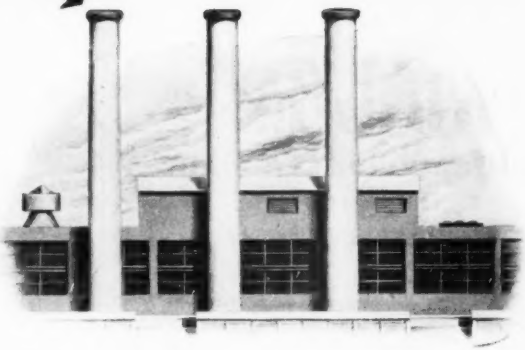
Factory-prepared mixtures of LUMNITE and selected aggregates. Mixed with water on the job, cast into place for door linings, arches, baffles, furnace walls. Special shapes can be cast in molds, ready within 24 hours. Castables to meet different temperature and insulation needs are made by refractory manufacturers, sold by their distributors.

STOP CORROSION... IMPROVE DRAFT

with LUMNITE STACK LININGS



Your steel stacks get full protection from corrosion and heat when LUMNITE linings are installed. These linings boost drafts by keeping gas temperatures up. They resist attacks of condensate and sulphurous gases. Linings are jointless, allow no "breathing." LUMNITE thus adds years of service to old stacks. In new stacks, LUMNITE heat- and corrosion-resistant concrete protects the steel indefinitely.

LUMNITE linings are easily installed. Reinforcing mesh is attached to steel angles or other projections welded to the steel shell . . . the mixture of LUMNITE and insulating corrosion-resistant aggregate is applied over the reinforcing mesh. Ready 24 hours after installation, LUMNITE linings reduce outage time to a bare minimum.

In stacks, as well as other power plant installations, listed in the column at left, LUMNITE provides high structural strength, high heat resistance and low thermal conductivity.

P-L-2

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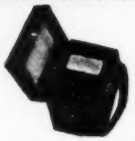

←**HYPOT** insulation breakdown and short tester. Discriminates between leakage breakdown. Voltage variable from 0 to 4000 volts AC. Fully grounded, portable, self contained. Reads actual secondary voltage applied. Red light warns when energized. Shielded leads.

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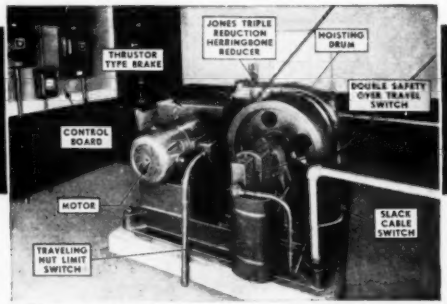
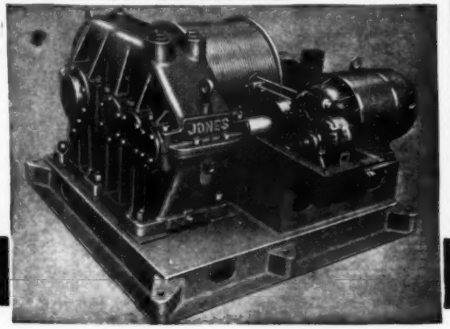


• The view above shows a typical Jones Skip Hoist Drive installation while the view below shows one of the Jones units equipped with traveling nut type limit switch, motor actuated brake, and slack cable switch.



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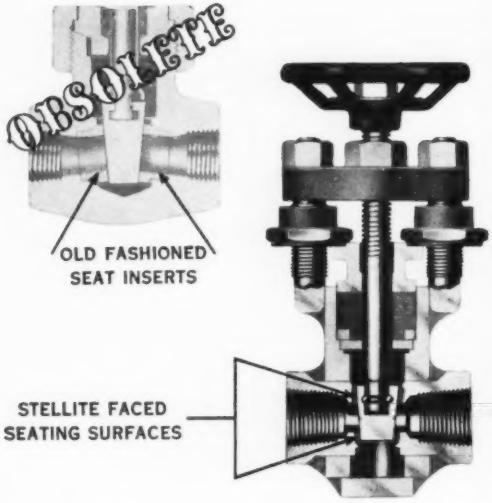

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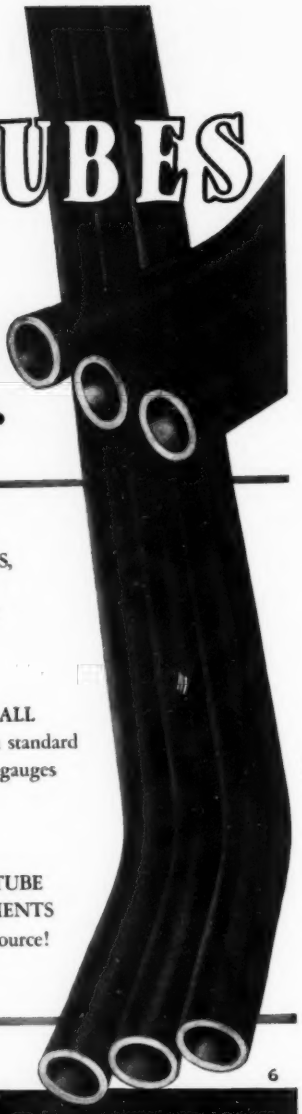

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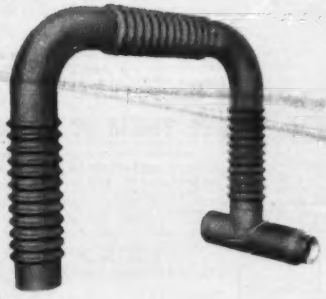

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SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (39 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL, $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

SALES ENGINEER, graduate, with unusually broad background in internal combustion engines, steam turbines, condensers, pumps and their accessory equipment, desires exceptional sales, purchasing or administrative opportunity. Five years experience includes advertising, contract, design, test, literary, sales, service and supervisory work. PW-7506 Power.

POSITIONS WANTED

MAINTENANCE SUPERVISOR or plant engineer. Age 34. Fourteen years experience in maintenance construction, operation of large high pressure boilers, turbines, turbine electric equipment, air conditioning, refrigeration and associated equipment. Familiar with marine codes, A.S.M.E. codes and modern technique of power plant maintenance including high pressure piping, automatic control instruments, water treatment, water cooling, recycling units, electrical and air distribution systems, machine shop, boiler repairing and welding. Capable of supervising all work on above mentioned equipment. Now employed as chief engineer of 10,000 KW plant. Will consider assistant's position with future, in Southwestern States. PW-7494, Power.

ELECTRICAL ENGINEER: 28, aggressive, good health, single. Graduate EE. Experience electrical designing, inspection and construction. Domestic construction position wanted. Associate AIEE. PW-7507, Power.

WELDING SUPERVISOR—American, now residing in Europe, available March 15th. Experienced in power piping, boiler and refinery work. Write: Basil Osmin, care Worldwide Contractors Clearence Corporation, 50 East 42nd Street, New York 17, New York.

CHIEF ENGINEER — Centrifugal pumps. Desires connection with live wire medium size mfr. to modernise existing lines or develop new up-to-date types from small close-coupled to split case multi-stage units. Over 32 yrs. exclusively in this design field. Unusually well fitted to produce lines streamlined for mass production, top notch efficiencies and appearance, thru highly standardized design of small parts and sub-assemblies. Excellent opportunity for mfr. of steam turbines or other allied lines wanting additional product. PW-7152, Power.

MAINTENANCE ENGINEER desires change. 30 years technical and practical experience operating steam and electric power plant with supervisory ability. Reference furnished. PW-7386, Power.

POWER PLANT Superintendent desires position as such. Twenty-years experience in operating and maintenance of H.P. generating stations. 47 years of age and married. Now employed as Plant Superintendent of one steam and one diesel generating plant. Services available on 30 days notice. PW-7385, Power.

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MANUFACTURERS REPRESENTATIVE with engineering background and high record of sales in past nine years, has openings for allied lines of equipment in heating, ventilating, and air conditioning for Philadelphia territory. RA-7719, Power.

TO EMPLOYERS who advertise for MEN:

WHEN there are many applicants for a single position it frequently happens that the only letters acknowledged are those of the most promising candidates. Others may not receive any indication that their letters have even been received by a prospective employer much less given consideration. These men often become discouraged, will not respond to future advertisements, and sometimes question their bona fide character.

Every advertisement printed in the Searchlight Section is duly authorized.

It will help to keep our readers interested in this advertising if you will acknowledge every application received, even if you merely return the letters of unsuccessful applicants with, "Position filled, thank you" written or stamped on them. If you don't care to reveal your identity, mail them in plain envelopes.

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SQUIRREL CAGE MOTORS

H.P.	Make	Type	Speed
450	G.E. vert.	KF-6338	1180
250	G.E.	IK	1180
350	G.E. (2)	K-568	575
200	G.E.	KF-6338Z	880
147	West.	25 cy.	1750
125	Al. Ch. (2)	AR-630F	450
100	G.E. (2)	K-544	1175
100	West.	CS	870
100	G.E.	KT-556	985
100	West. (2)	CS	690
75	West.	CS-5068	1760
75	West.	CS-662-C	1150
75	West.	CS	870
60	West.	504-S	1750
60	Rel.	AA-C5084Z	870
50	G.E.	FTR-823	3600
50	Elliott	196	3450
50	G.E.	K-445	1170
50	West.	CS	880
40	G.E.	KT-338	900
40	West.	CS	900

Partial List Only!

SLIPRING MOTORS

600	Cr. Wh.		514
200	G.E.	MTP	180
150	G.E.	MT-564Y	550
100	G.E.	IM	1800
100	Al. Ch.		690
75	G.E.	IM	870
75	G.E.	IM	690
60	Al. Ch.		590
60	G.E.	M-632BTEFC	705
50	West.	CW-564	1155
50	Al. Ch.	ARY	575
50	F-M	BV	575
50	G.E.	IM	490
40	G.E.	IM	1200

SYNCHRONOUS MOTORS

H.P.	Make	Type	Speed
600	G.E.	TS	900
400	G.E. (4)	TS-8525	600
200	G.E.	TS	900
200	Ideal (2)		257
180	G.E.	AT1	900
150	G.E.	AT1	720
150	G.E.	TS	1200
135	West.	G	1200
100	Elec. Prods.		1200

A. C. GENERATORS

288 KVA	West.	G		900
200 KW	West.	G		1200
75 KW	G.E.	ATB		360
75 KW	G.E.	ATB		1200

D. C. to A. C. GENERATORS

K.W.	Make	D.C.	A.C.
25	G.E.	230	220
25	Star	115	120
25	Ideal	115	440
25	El. Mchy.	230	440
7½	Hertner	115	440
5	El Spec.	110	110

600 V. GENERATOR

K.W.	Make	Speed
200	Cr. Wh.	900
30	Burke	1750
30	E.D.	1150

250 V. GENERATOR

K.W.	Make	Speed
500	West.	1100
330	Elliot	1200
300	G.E.	1200
300	Al. Ch.	1200
200	G.E. MPC	1200
150	West.	900
150	West.	1180
150	G.E.	600
50	G.E.	1200
30(3)	G.E.	1750
30	Cont.	1200
25	G.E.	1200
15	G.E.	1750
10	Star	1750
7½	West.	1200
5	West.	1750

125 V. GENERATOR

K.W.	Make	Speed
250	G.E.	720
150	Cr. Wh.	1200
150	West.	1150
100(2)	West.	900
100	G.E.	1200
100	El. Mchy.	1200
75	Cr. Wh.	1200
75	Hertner	1150
50	Sturt.	2800
40	Cont.	1450
30	Ideal (2)	1750
30	L.A.	1450
30	G.E.	1150
20	Delco	1200
15	G.E.	1150
10	Rogers	1450
7½	West.	1200
5	G.E.	1750

LOW VOLTAGE GENERATOR

Amp.	Make	Voltage
8000	H-V-W	6/12
5000	M-B-O'C(2)	6/12
2000	H-V-W	6/12
1000	Chandeysson (2)	6/12
1000	Cal.	6/12
125	Hobart(5)	7½
3000	Chandysson	12/24
1000	H-V-W	12/24
300	Star	15
67	Cont.	15
750	Star	15
1000	G.E.	15
800	G.E.	22/28
600	Rel.	24
134	West.	24
175	Cr. Wh.	25
55C	Cal.	27
1600	G.E.	30
800	G.E.	30
100	G.E.	30
200	West.	30
205	G.E.	32
1000	G.E.	33
1000	Chandysseen (4)	40
500	Chandysseen (3)	40
205	G.E.	42
24	G.E.	44/54
75	G.E.	50/10
800	G.E.	50

550 V. D. C. MOTORS

H.P.	Make	Type	Speed
785	G.E. (6)	MPC	1045/1350

230 V. D. C. Variable Speed Motors

100	Rel.	1050-T	400/1200
100	G.E.	CD-173	400/1200
75	G.E.	D	500/1500
75	Cr. Wh.	CMC-125H	375/750
60	G.E.	C	490/1100
55	Cr. Wh.	CCM-125H	155/500
50	West.	SK	500/1500
50	West.	SK	250/1000
40	Reliance	461T	400/1200
40	G.E. (3)	CD-1441	400/1500
25	West.	SA	500/1500
25	Rel.	185-T	500/1500
25	G.E.	RF-13	400/1200
25	G.E.	RF-14	400/1200
25	G.E.	RF-14	300/1200
20	G.E. (6)	RF-12	400/1200
20	West.	SK	375/1500
15	West. (4)	SK-95	600/1500
15	E.D.		500/1500
15	West.	SK-120	350/1000
15	West.	SK	250/1000
15	West.	SK	500/1500
10	G.E.	RF-10	600/1800
10	G.E.	CD-83	600/1800
10	West.	SK	600/1200
10	West. (3)	SK	500/1500
10	G.E.	RF	400/1800
10	G.E. (3)	RF	400/1200
10	Rel.	131-T	250/1000
7½	West.	SK-70	500/1500
7½	G.E.	RF-10A	450/1600
7½	Al. Ch.		350/1050
5	West. (3)	SK-50	500/1500
5	G.E.	RF-9	450/1800
5	G.E.	RF	450/1800
5	Rel. (2)	46-T	400/1600

230 V. D. C. MOTORS

150	G.E.	RC-19	800
125	G.E.	CDP125	1300/1750
100	G.E.	RC-14	1750
75	West.	SK-170	635
75	West. (2)	SK-180	475
75	Cr. Wh.	52-HM	480
60	West. (2)	SK-160	680
50	West.	SK-133	1300
50	Diehl	K-10	650

230 V. D. C. MOTORS (Cont.)

50	West.	SK	780
50	West. (2)	SK-140	585
40	West.	SK-103	1750
40	Century	DN-484	1740
40	G.E.	RC	1750
40	G.E.	RC-32	1100
40	G.E.	RC-13	1075
30	G.E. (2)	RC	1200
30	West (2)		975
30	G.E. (2)	RC-33	775
30	West. (2)	SK-143	575
20	G.E. (2)	CD-83	1750
20	G.E. (2)	RC-11	1150
20	Star (2)	SR-316	29.2

115 V. D. C. MOTORS

300	West.	SK	900
100	Cr. Wh.	CMC	900
25	G.E. (2)	CD	1800
25	Cr. Wh.	CCM	750
20	Century	R8	1750
20	G.E. (2)	CD-83	1750
20	West.	SK-110L	750
12½	G.E.	CDM-85	930/1160

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300 KVA—Al. Ch. 3 phase, 4160 V. primary 230 V. secondary.
300 KVA—Pittsburgh, 3 phase, 4160 V. primary, 230 V. secondary.

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150—230 V. Magnetic 5 H.P. to 75 H.P. G.E.—C-H—A-B—W.L., etc.
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40—7½ H.P. 230 V. C H—Magnetic reversing.

A. C. STARTERS

1—475 H.P. West. Magnetic Reduced voltage, 550 V. synch.
4—400 H.P. 440 V. C-H Bal. 9576 Mag. Red. Volt. Synch.
1—250 H.P. C-H 4150 V. synch. full voltage.
1—150/200 H.P. G.E.—440 V. CR-7065 Syn.
3—150 H.P. G.E. 220 V. Cr. 7061 Synch.

NEW A. C. STARTERS

40—C-H. & A-B 2 and 4 speed Magnetic up to 25 H.P.
20—50 H.P. C-H. 440 V. Magnetic.
165—20 H.P. W.L. 440 V. Magnetic.
635—7½ H.P. C-H. 440 V. Magnetic.

AIR COMPRESSORS

425 Cfm. Sullivan 2 stage.
360 Cfm. American 125 lbs.

ELECTRIC & AIR HOISTS

17—2 ton Shepard-Niles 230 V. D.C.
8—500 lbs. P & H. Zip Lift, 3 phase.
2—2 ton Yale & Towne, 3 phase.
1—2 ton Shepard-Niles, 3 phase.
1—½ ton Yale & Towne, 3 phase.
1—2 ton Thor, pneumatic.
1—½ ton Thor, pneumatic.

400 CY. GENERATORS

2—3 K W GE 3/400/110.
1—7½ K W GE 3/400/240.
1—10 KW GE 200/700 Cy.
1—15 KW GE 3/400/240.

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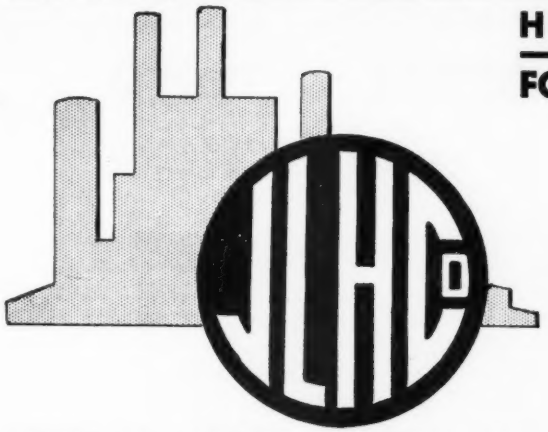

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1—1000 KVA G.E., 3 Ph. auto 4150V.—2300V.
1—500 KVA Kuhlman 4150 volt primary 2300 volt Sec.
3—300 KVA, Pitts., 2300 V. Pri., 115/230 V. Sec.
3—300 KVA, G.E., type H, 2300 V Pri., 115/230 V Sec.
300 KVA, Pitts., 7800-440 v.
205 KVA, Whse., 2 phase, 2300 to 3 ph., 4150 autp.
200 KVA, 4000 v.—110/220.
100 KVA, Pitts., 1375/2750 v.—110/220.
3—100 KVA, Wagners, 240/120 v.—120 v.
2—100 KVA, Newark, 440 v., 3 phase to 220 v., 2 phase.
2—100 KVA, Whse., 13,800 v. to 250 v.
3— 75 KVA, G.E., 2400 v.—120/240.
6— 50 KVA, Whse., 2400 v.—120/240
6— 50 KVA, Whse., 13,800 v. to 125 v. or 250 v.
6— 50 KVA, Whse., 6900 v. to 125 v. or 250 v.

A. C. GENERATORS

2500 KVA, Whse., Syn. Cond., 720 RPM, 2400 v.
500 KW, .8 P.F., 3600 RPM, ATB, 600 v.
320 KW, Allis, 450 RPM, 480 v.
240 KW, G.E., ATB, 600 RPM, 600 v.
200 KVA, Allis, 3600 RPM, 240 volt.
200 KVA, Whse., 600 RPM, 240 v.
180 KW, Whse., 514 RPM, 550 v.
165 KW, El. Mach., 514 RPM, 240 V.
100 KW, G.E. ATB, 600 RPM, 240 v.
75 KW, Whse., 900 RPM, 220 v.
62½ KW, Allis, 3600 RPM, 220 v.
7— 50 KVA, Whse., 900 RPM, 220 v.
3— 35 KWA, Columbia, 1200 RPM, 240 v.
1— 31.3 KVA, America, 1200 RPM, 120/208.
15 KW, Star, 1800 RPM, 220/440.
12.5 KVA, Whse., 1200 RPM, 240 v.

TURBINE BLOWERS

1—Spencer Turbine Blower, 1000 cubic feet, 30 oz. pressure with a 15 H.P., 3600 RPM, General Electric Type FT, 200 volt motor.
1—Bellmore, 550 cubic feet, 7 inch vacuum, with a 20 H.P. 3600 RPM, General Electric, Type K, 220 volt 3 phase motor.

MOTORS, 3 Phase, 60 Cycles
SQUIRREL CAGE

750 H.P., General Electric, 750 RPM, 6600 v., 25 cycle.
450 H.P., Ridgeway, 900 RPM, 2200 volts.
125 H.P., G.E., KF, 1750 RPM, 2200 v.
125—H.P., U.S., 1200 RPM, Vert., 220 volts.
150 H.P., G.E., KT, 1200 RPM, Vert., 220 volts.
100 H.P., G.E., 400 RPM, 440 volt.
75 H.P., West., CS, 1750 RPM, 440 volts.
60 H.P., Whse., 900 RPM, Vert., 2200 volts.
60 H.P., Whse., 900 RPM, 440 volts.
2— 40 H.P., G.E., 900 RPM, 220 volts.
35 H.P., Whse., 1200 RPM, CS, 2200 volts.

MOTORS, 3 Phase, 60 Cycles
SLIP RING

2500 H.P., G.E., 257 RPM, 6600 volts.
450 H.P., G.E., 425 RPM, ITC, 440 volts, 25 cycle.
2— 150 H.P., G.E., 1M, 440 volt, 450 RPM.
100 H.P., G.E., IM, 440 volt, 25 cycle, 720 RPM.
75 H.P., Whse., CW, 720 RPM, 440 volt.
75 H.P., G.E., MT, 1200 RPM, Vert.
50 H.P., G.E., MT, 600 RPM, 220 volt.
2— 50 H.P., Whse., CW, 900 RPM, 220 volts.
40 H.P., Cont., 1200 RPM, JA85, 220 volt.
40 H.P., G.E., 1200 RPM, MT, 220 volt.
40 H.P., G.E., 900 RPM, 220 Volt, ITC.
40 H.P., G.E., 900 RPM, MT, 900 RPM, 220 volt.
40 H.P., G.E., 900 RPM, 2200 volt.

AIR COMPRESSORS

312 CFM, 100 lb. Ingersoll Rand, model 75, with motor.

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D.C. MOTORS AND GENERATORS

SYNCHRONOUS MOTORS

4—200/100 H.P., Whse., 720/360 RPM, 4150 v.
200 H.P., Whse., 600 RPM, 240 v.
1—200 H.P., G.E., 257 RPM, 440 volt.
1—150 H.P., G.E., 1800 RPM, 220 v., TS.
75 H.P., G.E., 1200 RPM, 440 v.
70 H.P., Elect. Mach., 180 RPM, 2300 v.
40 H.P., Whse., 1800 RPM, 220 v.
35 H.P., G.E., 1200 RPM, 2200 v.
20 H.P., Whse., 1800 RPM, 220 v.

MOTOR GEN. SETS

1—1000 KW, G.E., 600 volts—4150—514 rpm, Syn.
1— 400 KW., G.E., 250 V. 900 RPM, 2300 V. Syn.
1— 500 KW., G.E., 575 V. 900 RPM, 2300 V. Syn.
125 KW, CW, 125 v., 1200 RPM, 2300 v. sq. cage.
100 KW, El. Mach., 125 v., 1200 RPM, 4150 v. syn.
100 KW, G.E., 230 v., 900 RPM, 4150 v. Syn.
2— 75 KW., G.E., 125 v., 1200 RPM, 220/440 v.
6— 75 KW, G.E., 60 v., 1200 RPM, 220/440 v.
50 KW, Ridgeway, 550 v., 1200 RPM, 220 v.
25 KW G.E., AT1, 1800 RPM, 40 HP, 1800 RPM, 230 v.

PLATING M. G. SETS

250 amp, G.E., 5/6 volt, 220 v.
500 Amp., Hansen Van Winkle, 24 volt, 220/440 v.
2500 Amp., Chandeysson, 6/12 v., 400 RPM, Syn., 440 v.
3000 Amp., Chandeysson, 6/12, 400 RPM, syn., 440 v.

ENGINE GEN. SETS

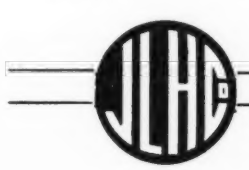
150 KVA, G.E., Ames Uniflow, 220 v., 3 ph., non-cond.
2— 5 KW., Gasoline, Hobart, 1800 RPM, 120 v., 1 ph. cond. engines.
1—200/275 H.P., Gasoline Engine, Van Blerck, 8 cylinder, 1500/900 rpm.

TURBO. GEN. SETS

625 KVA, Westinghouse, 2400 v., 3 phase, non-con.
300 KW, G.E., ATB, 240 v., 3 ph., cond.
60 KW, Whse., 120 v., D.C., cond.
30 KW, Allis, 120 v., D.C., Terry non-cond.

STEAM TURBINES

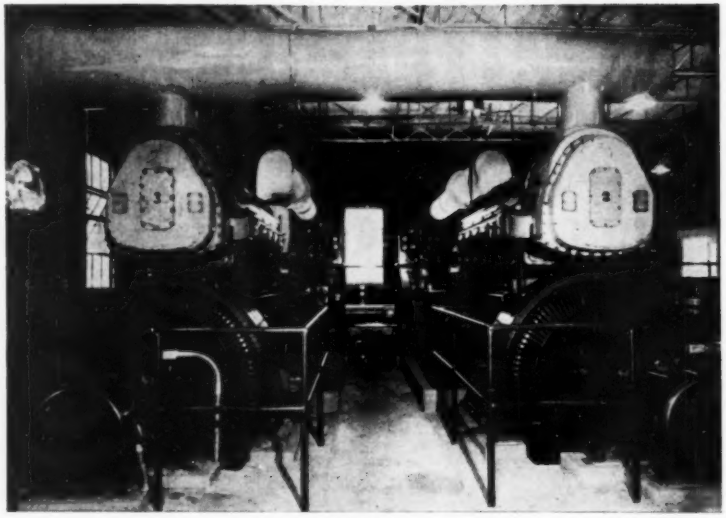
500 HP., G.E., 3 stage, 165#, 3240 RPM.
800 HP., Terry Tandem type, 720 RPM, red. gear.



THIS SEAL IS YOUR GUARANTEE

"FOR POWER"
J.L. HEMPHILL & CO.
1604 53rd STREET, NORTH BERGEN, N. J.
PHONE NEW YORK—LONGACRE 5-3227
PHONE NEW JERSEY—UNION 3-2600

Another AGSCO DIESEL POWER INSTALLATION



Engineered and installed by A. G. SCHOONMAKER CO. INC., at Swans Falls, New Hampshire, these 1000KW Fairbanks Morse Diesel Engine Generating Units are in continuous, Heavy-duty service.

UNITS AVAILABLE FOR IMMEDIATE SHIPMENT

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1420	Fairbanks Morse	38D8⅛	1600	720	300	Fairbanks Morse	YVA	360	257
*1250	General Motors	16-278	1600	720	250	General Motors	8-268A	350	1200
1250	Nelseco	6MI-53	1500	300	125	Murphy	ME-605	145	1200
1000	General Motors	12-278'	1200	720	125	Enterprise	GDB-8	150	1200
*900	General Motors	12-567	1100	720	125	General Motors	3-268A	150	1200
*625	Superior	OS	750	327	121	Fairbanks Morse	32E14	140	300
500	General Motors	6-218A	600	720	75	General Motors	6043C	90	1200
425	Baldwin	VO-6	510	450	75	Fairbanks Morse	35E8¾	90	450(BC)
375	Enterprise	DSG-6	450	450	62	Int'l Harvester	UD-18	76	1200
375	Worthington	HD-6	450	450	50	General Motors	4-71	60	1200
312	General Motors	8-268A	450	1200	18	Int'l Harvester	UD-6	22	1200

* ALSO AVAILABLE AS PORTABLE UNITS

WE OWN WHAT WE OFFER

Engineered AGSCO DIESEL POWER

A. G. SCHOONMAKER Company, Inc.

ESTABLISHED 1898

Diesel Engines • Power Machinery

52 CHURCH STREET, NEW YORK 7, N. Y. PHONE DIgby 9-4350

Something to remember:

OUR 41 year REPUTATION IS YOUR PROTECTION

WHEN YOU BUY RE-NU-BILT FROM BELYEA

RE-NU-BILT EQUIPMENT

Rebuilt in accordance with N.I.S.A. Rebuilding Standards

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	1800	G.E.	600	125/250	4000
1	1500	G.E.	600	600	2300/4150
1	1500	G.E.	360	275	2200/4400
1	1250	G.E.	600	275	2300
1	1000	West.	514	250	4150
1	1000	Whse.	514	600	4150
1	800/30	G.E.	1200	120/240	2300
2	500	G.E.	720	600	2300/4150
1	500	G.E.	720	125	2300/4000
2	400	G.E.	720	250	440/2300
1	400	G.E.	1200	120/240	440
1	350	G.E.	900	125	50
1	300	G.E.	1200	250	440
1	250	Whse.	1200	250	440
1	150	Cr. Wh.	1200	250	440
1	100	G.E.	1170	125	220
1	100	G.E.	1200	250	2200
1	90	G.E.	1800	60	220/440
1	75	Cr. Wh.	1160	250	220/440
1	75	G.E.	1180	125	2300/4000
1	60	Whse.	1150	60	220/440
1	50	G.E.	1145	125	220
2	50	G.E.	1200	250	2200

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	3000	Whse.		4800	720
1	3000	G.E.	ATI	4800	720

ROTARY CONVERTERS

60 Cycle

KW	Make	Speed	D.C. Volts	A.C. Volts
1—2000	G.E.	514	600	2300
1—3000	G.E.	450	600	2300
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 500	Whse.	900	250	2300

FREQUENCY CHANGER SETS

1—1000 KW—GE—2 unit—3 Brg. Consisting of—1400 HP—4400 V, 3 ph. 25 cy. Motor and 1000 KW—2300 V. 2 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW 3 ph.)

1—320 KW—GE—2 Unit—3 Brg. consisting of 600 HP—440 V., 3 ph. 60 cy., 8 pf. Syn. Motor and 400 KVA, .8 pf. type AT—3 ph. 120 cy. 720 volt AC generator with direct connected exciter.

D. C. MOTORS

HP	Make	Type	Volts	Speed
5—1500	Whse.		525	600
1—1200	Whse.		600	425
1—800/1000	Whse.		450	600/720
1—700	G.E.	MCF	600	130/625
1—650	G.E.	MPC	250	115/145
1—300/400	G.E.	DYNA	250	1328/2500
1—335	Whse.	MQ	250	300/900
1—200/300	G.E.	MPC	230	360/920
1—275	Whse.	QM-600-6	230	425/850
1—250	G.E.	MPC	230	400/800
1—230	Al. Ch.		230	700
1—150	G.E.	MPC	230	250/450
1—150	Cr. Wh.	CCM	230	500/1050
1—150	G.E.		600	250/750
10—150	Cr. Wh.	83H	230	890
1—150	Cr. Wh.	CMC-65H	230	1150
1—125	G.E.	CO-1832	230	625
1—125	El. Dy.	308	230	750/1500
1—115	Cr. Wh.	JHL	230	1200
3—101	Whse.	6K	230	485/950
1—100	Rel.	1050T	230	400/1200
1—50/100	G.E.	CD-175	230	365/730
2—80	El. Dy	308	230	475/1350
1—75	Whse.	SK-100L	125	650
2—75	El. Dy.	25-SL	230	750/1750
3—60/75	Whse.	SK-200	115	300/700
4—75	Cr. Wh.	53-H	230	860
1—60	Whse.	SK-160	550	680
1—60	El. Dy.	25-S	230	525/1050
2—60	Whse.	Hoist.	230	415
1—60	Whse.	SK	230	500/1000
1—60	Whse.	SK-131	230	500/1500
1—60	El. Dy.	25S	230	750/1500
2—50	G.E.	RCP-31B	230	1700
1—50	G.E.	RC-34	230	1050
1—50	G.E.	RF-16	230	500/1500
1—50	Whse.	SK-131	230	500/1500
4—50	Whse.	Hoist	230	400
1—50	Whse.	SK-153	230	690/1035
1—50	G.E.	CD-123	230	675/1035
1—50	Cr. Wh.	CMC-8014	230	380/750

SPECIAL—MERCURY ARC RECTIFIERS

1—750 KW—GE—Type RdW—6 Anode 575 V., D.C. Form C with 2300 V., 60 cycle transformer and switching equipment.

1—1000 KW—American B.B. Type GRZ-612—12 anode 625 V.D.C. with 1040 KVA O15C—3 phase—13200/6600V-25/60 cycle transformer with full automatic switching equipment along with 2 distribution panels.

1—1000 KW—Al.Ch. type B-612—12 anode 625 V.D.C. with 1140 KVA O15C—3 phase—13500V.—60 cycle transformer with manually operated switching equipment along with voltage regulator and grid control.

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
1—2100	G.E.	ATI	4600	510
2—2000	Whse.		2300	120
1—1000	Whse.		2300	189½
2— 900	Al. Ch.	(New)	2200	150
1— 600	Whse.	Syn.	440	360
1— 500	G.E.	ATI	480	900
2— 500	G.E.	TS	4150	600
1— 450	Whse.	Eng.	2200	128.5
2— 350	G.E.	TS	2200	180
1— 325	Whse.		440	900
1— 320	G.E.	ATI	2300	900
1— 300	G.E.	ATI	440	720
1— 300	Whse.		2300	720
1— 300	Al. Ch.		440	900
1— 145	G.E.	ATI	550	720
2— 125	G.E.	ATI	440	450
1— 100	Whse.		550	900

SLIP RING

1—1000	Whse.	CW	2300	700
2— 700	Whse.	CW	2200	900
1— 500	G.E.	IP	550	505
1— 500	G.E.	IM	2200	
3— 450	G.E.	IM	440	506
1— 400	G.E.	IM	2200	252
3— 350	Whse.	CW	2200	900
1— 350	G.E.	MT-442Y	2200/4000	253
1— 300	Al. Ch.	3 Brg.	2300	700
1— 250	G.E.	MT-363Y	550	435
1— 250	G.E.	MT-424Y	4000	750
1— 250	G.E.	MT-559S	2200	1750
1— 135	G.E.	IM	2300	505
2— 100	G.E.	IM-16	2200	900
1— 75	Whse.	CW-761	2300	1257
1— 75	F.M.	By-H16B	2300	1800
1— 60	Cr.Wh.	123-AQ	220	700
3— 50	Whse.	CI-638A	220	870
2— 50	Whse.	CIW-504	440	870
1— 50	Rel.	1XM	2300	880

SQUIRREL CAGE

1— 250	G.E.	KT-559	440	1800
1— 250	G.E.	IK		
1— 200	G.E.	IK	550	885
1— 200	G.E.	KT-557	440	1800
1— 125	Whse.	MB	440	488
1— 125	(New) G.E.	KF-TEFC	440	1190
1— 125	G.E.	KF-TEFC	440	3585
1— 100	G.E.	IK	440	575
1— 100	G.E.	IK-Vert.	2300	460
1— 100	G.E.	KT-543	220/440	1780
1— 75	G.E.	IK	2200	1200
2— 60	G.E.	K-505	440	1170
1—60/20	Whse.	CS	220	900/450
1— 50	G.E.	KF-4058	220/440	3550

Turbo Generators

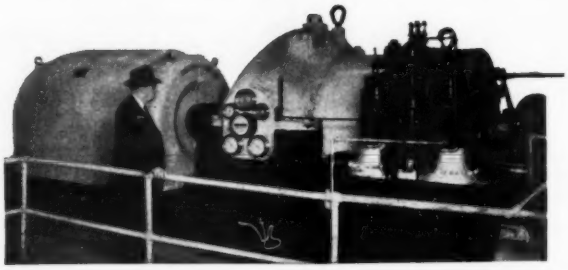
See our advertisement on page 289

BELYEA CO., INC.

Main Office and Shop

43 HOWELL ST., JERSEY CITY 6, N. J.
Phone—Journal Square 2-3334
Also N. Y. City Line—Rector 2-7150

THIS MONTH'S SPECIALS



2-3750 KVA WESTINGHOUSE

3/60/2300-V: Condensing With All Auxiliaries: Complete Installations
1—New 1075-KVA., General Electric, 450# Psi: ALL IMMEDIATE DELIVERY
OUR SPECIALTIES: TURBO-GENERATORS: DIESEL POWER, BOILERS

TURBINE-GENERATORS

Partial Stock List

Stock Nos.

1—4375-KVA. G.E., Never Used Since Rebuilt at Cost—$27,500. New Condenser and New Auxiliaries: No. 1 Machine
2—3125-KVA., 250# psi, 2300-V., West. Cond., No. 1 Condition
3—3125-KVA., G.E., 200#, 2300-V., Surf. Cond., Complete Installation
4—1875-KVA., Allis-C., New Coils, New Buckets, Never Used Since Rebuilt
5—1565-KVA., G.E., Non-Cond., 480-V
6—1565-KVA., West., 2300-V., Condensing
7—1250-KVA., G.E., 480-V., Condensing
8— 895-KVA., Allis-C., 480-V., 200# psi.
9—Several 625-KVA., 3—375-KVA., 2—425-KVA., and Many Others
Condensers, Condenser Auxiliaries, All Power Plant Equipment, In Stock, NEW

ALWAYS SEND US YOUR SPECIFICATIONS

DIESEL POWER

In Stock for Immediate Delivery:

Several 1250-KVA., Diesel Engine-Generator Sets. Complete with Shaft Exciters, Switchboards, Etc.

Bulletin 320 Covers Them: Send for it Today

Also several 600 H.P. Cooper-Bessemer Diesel Engines.

SEND US YOUR SPECIFICATIONS FOR ANYTHING WANTED IN DIESEL POWER

ALWAYS GET WEAVER'S PRICES BEFORE BUYING: ARE MONEY SAVERS

BOILERS

Let Us Figure with You on Boilers: Have Several New in Stock: Also Good Used Condition Boilers.

YOUR COOPERATION INVITED

WIRE WRITE OR PHONE

CHARLES WEAVER

Electrical-Mechanical Engineers

41st Floor, Penobscot Building Detroit 26, Michigan

Telephones:
Woodward 1-1340
" 1-1341
" 1-6038

POWER EQUIPMENT—READY TO SHIP

SAVE OVER 50% ON NEW INDUSTRIAL BLOWERS AND VENTILATING FANS

AXIAL FLOW VENTILATING FANS

6—16000 CFM Buffalo Forge Co., 3" stat. pres. 1800/1200 rpm. con. 15/4.5 HP., 1710/1150 rpm., 3 ph. 60 cy. G.E. A.C. Motor 220/440 v. totally encl.

3—12000 CFM 3" stat. pres. Sturtevant with dir. con. 10/3 HP., 1775/1180 rpm., 220/440 v. West. CS. TEFC Motor.

1—7800 cfm Clarage with dir. con. 7½ hp., 1750 rpm., 3.3 HP. at 1150 rpm., 220/440 v. 3 ph. 60 cy.

31—6000 cfm Sturtevant Bulletin 512389, 3" stat. pres. 7 blade, dir. con. 5/1.5 HP., 1765/1175 rpm., 220/440 v. 3 ph. 60 cy. West. TEFC Motors.

3—5800 cfm Sturtevant 1.8 stat. pres. 4.2/1.25 HP., 1750/1150 rpm., 3 ph. 60 cy. 220/440 v. ball bearing motors.

2—4000 cfm 3" stat. pres. Sturtevant dir. con. 2 speed, TE Westinghouse 220/440 v. Motors.

BRAND NEW TURBO SET

Westinghouse Steam Turbine consisting of 200 kw., 220/440 v., 3 ph. 60 cy. 1200 rpm., 80% P.F. A.C. Generator—40 kw., 120 v. 1200 rpm., D.C. Exciter and Westinghouse Reduction Gear. — Non-condensing.

A.C. MOTORS—3 PH. 60 CY.

No.	H.P.	Make	Type	RPM	Volts
1 new	500	Elec. Mach.	Syn.	120	4000/2200 220/440
3	300	Elec. Mach.	Syn.	720	2200
2	250	G.E.	I	1200	2200
2	200	G.E.	I	880	2200
1	200	West.	CS	900	440
1	175	West.	MS	900	220
1	150	West.	MS	900	220
1	150	West.	Syn.	900	220/440
1	150	West.	Syn.	257	220/440
4	150	L. Allis	Splash Proof	1800	220/440
1	125	Elec. Mach.	Syn.	164	220/440
2	100	Reliance	IT	495	220/440
3	100	Elec. Mach.	Syn.	720	220/440
1	100	Allis Chal.		1200	220/440
1	100	West.		1200	220/440
2	100	Louis Allis	OGS	1750	220/440
5	100	Louis Allis	PA	1750	220/440
1	75	Stanley		600	220/440
1	75	Chandler	Syn.	600	220/440
1	75	Elec. Mach.	Syn.	900	220/440
1	75	Louis Allis	OGS	1200	220/440
2	75	Louis Allis	FAA	1150	220/440
1	75	G. Elec.	KT-343	1150	220/440
3	75	Armour	AXB	1150	220/440
1	75	Burke	EM-7	1200	220/440
2	75	West.	CS	1800	220/440
1	60	Burke	EM-7	900	220/440
1	60	G.E.	KT-343	900	220/440
3	60	Armour	AXB	900	220/440
1	60	West.	CS-453	1200	220/440
1	60	G.E.	KT-533	1800	550
1	50/33	G.E.	POS	800/640	220/440
1	50	West.	CS-455-A	870	220/440
1	50	Fynn-Weis.	22-V	900	220/440
2	50	G.E.	KT-346	900	220/440
1	50	G.E.	KT-342	1200	220/440
1	50	West.	CS	1200	220/440
1	50	American		850	220/440
1	50	G.E. T.E.F.C.	K-445	1770	220/440
1	50	West.	M-8	1800	220/440

A. C. GENERATORS—3 ph. 60 cy.

No.	KVA	Make	RPM	Volts
1 new	450	Elec. Mach.	120	4000/220 220/440
3	115	Elec. Mach.	720	220/440
1	100	Elec. Mach.	164	220/440
1	100	West.	600	220/440
1	75	Elec. Mach.	900	220/440
1	50	G.E.	1200	220/440
1 new	50	Elec. Mach.	1200	220/440
1	37½	Ft. Wayne	1200	220/4400
1 new	25	G.E.	900	220/440
4	25	O'Nan	1800	220/440

BARGAIN — FOR SALE
100 KW. DIESEL ENGINE GENERATOR SETS

11—100 KW., 120/240 V. D.C. Delco Generators dir. con. to 150 HP., Model GBD-8, 5½x7, 8 cyl. Superior Diesel Engines, elec. starting with muffler, power panel and accessories.
2—100 kw 220/440 V AC same as above.
Practically as good as new—Only Used for Spares.

250 VOLT D.C. GENERATORS

No.	KW	Make	Type	RPM
3	250	West.		1200
1	200	West.	SK	500
1	110	West.	SK-190	700
8	100	Reliance	1050-T	580
1	100	West.	SK-153	720
1	100	West.	SK-190	720
1	100	West.	SK-180	900
6	100	Delco		1200
1	100	G.E.	RC-58	850
1	100	West.	SK	850
1	100	G.E.	RCP-36	3100
1	75	Allis Chal.		850
2	75	West.	SK	1400
1	60	West.	SK	2100/1980
1	60	West.	SK-153	1100
1	50	West.	SK-180	400
1	50	G.E.	DLC-203	850
1	50	West.	SK-143	1100

MOTOR GENERATOR SETS—250 V.D.C.
Motors 220/440 volt or 2200 volt 3 phase, 60 cycle

No.	KW	Make	RPM
3	250	Westinghouse	1200
1	200	Westinghouse	720
2	200	Westinghouse	1200
1	100	Westinghouse	700
1	100	General Electric	900
1	100	Westinghouse	600
1	100	General Electric	1800
1	100	Reliance	580
1	100	Delco	1200
2	90	Westinghouse	680
4	75	Westinghouse	720
1	75	Westinghouse	1200
1	60	Westinghouse	1200
1 NEW	50	General Electric	1800
3	40	Westinghouse	900
2	30	Westinghouse	720

VARIABLE SPEED MOTORS—230 V. D.C.

No.	HP	Make	Type	RPM
1	200	West.	SK	400/1000
8	100	Reliance	1050-T	400/1000
1	100	G.E.	RC	680/1200
2	100	West.	SK-183-A	575/1150
1	100	West.	SK-190	500/1000
1	100	West.	SK	600/1200
1	75	West.	SK	1100/1800
2	75	West.	SK	850/1700
1	50	West.	SK-180	320/960
1	50	West.	SK	300/1200
1	50	West.	SK-191	350/1050
1	50	West.	SK-143	850/1750
1	40	Allis Chal.		400/1200
2	30	G.E.	DLE-80	400/1200
1	30	G.E.		800/1200
1	25	G.E.	CD-123	300/1200
1	20	West.	SK-123	400/1800
1	20	G.E.	RF-11	500/1500

SPECIAL BARGAIN AIR COMPRESSOR

6—240 CFM Westinghouse type 3 VS-23 3 cyl. vert., 150 lbs. pres. dir. con. to 50 HP., 220/440 or 2200 v. 3 ph. 60 cy. West Slip Ring Motors, auto. control. Can furnish D.C. Motors or Oil or Gasoline Engines if desired.

SLIP RING MOTORS—3 ph. 60 cy.

No.	H.P.	Make	RPM	Volts
1 New	400	West.	600	2300
1	250	Allis Chal.	870	2200
1 New	200	G.E.	600	220/440
1	200	West.	1800	220/440
1	150	G.E.	1800	220/440
1	150	West.	1150	220/440
1	125	West.	860	2200/220/440
1	100	West.	720	2200/220/440
1	100	Triumph	580	550/220/440
1	75	G.E.	600	550/220/440
1	75	G.E.	720	220/440
1	75	G.E.	900	220/440
1	75	West.	1800	220/440
1	60	West.	900	220/440
1	60	G.E.	720	220/440
2	50	West.	870	220/440/2200

25 CYCLE A. C. MOTORS
3 ph. — 220-440 volts

H.P.	Make	Type	RPM
150	West.	CW	400
100	West.	CW	725
75	West.	MS	400
75	G.E.	M	715
60	West.	CS	1450
50	L. Allis	OGS-115	720
50	Armour	AB-1	720
50	West.		475
40	West.		725
25	West.	MS	715
20	West.	CS	715
20	Allis Chal.		715
15	Allis Chal.		1450
10	West.	CS	725

REDUCED VOLTAGE STARTERS—220 V. 3 ph. 60 cy.
7—100 H.P. Westinghouse Class 11-400
HUNDREDS of A.C. & D.C. BRAND NEW STARTERS all sizes—Gov. Surplus—BARGAIN PRICES

FREQUENCY CHANGERS

1—25 kw., 220/440 v. 3 ph. 180 cy., G.E. dir. con. to 25 HP., 1800 rpm., 220/440 v. 3 ph. 60 cy. motors.

SYNCHRONOUS MOTORS

1—New 500 HP., Elec. Machy. Co. 2200/220 or 440 v. 120 rpm.

ENGINE GENERATOR SETS

10—NEW 1 kw. 14.25 v. D.C. and 2 kw., 28.5 v. D.C. Homelite portable gas eng. Gen. sets. Can furnish lamps and batteries. Suitable for farms and camps.
3—5 kva. 120/240 v. 1 ph. 60 cy. Witte Diesel.
2—37½ KVA 220/440 volts 3 ph. 60 cy. Buda DIESELS.
1—50 kva. Elec. Machy 220/440 v. 3 ph. 60 cy. dir. con. Climax GASOLINE Engine.
1—125 kva. 220/440 v. 3 ph. 60 cy. 257 rpm., Erie Ball STEAM.
1—125 kva. G.E. 220/440 v. 3 ph. 60 cy., dir. con. Skinner UNIFLOW Engine.

INDUCTION HEATING CONVERTER

New Van Norman, type indoor, floor, hi-freq. 32 kw. 220 v. 1 ph., 60 cy. 150 A. enclosed type.

HOISTS or WINCHES

200—1½ Ton HAND CRANKED ratio 27:1 thru an enclosed double reduction gear unit with 4 planetary gears mounted on steel plate complete with 45' of ¼" cable, ratchet type brake, push button release.

CAR PULLER or WINCH

1—Welen, 2 drum Winch or Car Puller rated 8500# per drum with 25 HP. G.E. Vertical Motor 220 v. D.C.

GEAR HEAD MOTOR

50 HP., G.E. 220/440 or 550 v., 3 ph. 60 cy., 1755 to 13 rpm., splash proof, ball bearing.

PORTABLE COMPRESSOR

1—315 CFM Ingersoll Rand portable 100 lb. pres. driven by 105 HP Waukesha Oil Engine, 800 rpm.
FOR SALE OR RENT

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

Our 43rd Year

WAGNER

Quality and Service

"CERTIFIED REBUILT"

THE MARK OF DEPENDABLE ELECTRICAL EQUIPMENT

MOTORS . . . GENERATORS . . . M-G SETS

PUMPS . . . FANS . . . BLOWERS . . . SPEED REDUCERS

PARTIAL STOCK LISTING—WRITE, WIRE OR PHONE YOUR REQUIREMENTS

250 KW Allis-Chalmers M-G Set, DC 120/240V. output, 363 H.P. Synch. Motor, 3/60/440V. 1200 RPM, AC & DC panels, late model.

M-G SETS

KW	Mfr.	Input V	Output V
150	Cr. Wheeler*	220/440 AC	250 DC
105	Century b.b.	220/440 AC	70 DC
100	Gen. Elec.*	220/440 AC	250 DC
100	Gen. Elec.*	220/440 AC	125 DC
75	Whse.	220/440 AC	125 DC
75	Star b.b.*	220/440 AC	250 DC
75	Star b.b.	240 DC	230/490 AC
50	Gen. Elec.	220/440 AC	125 DC
40	Whse.	220/440 AC	250 DC
40	North w'n Conv.	220 AC	230 DC
35	Gen. Elec.	220/440 AC	48 DC
30	Ideal	220/440 AC	125/250 DC
30	Elec. Prod.*	220/440 AC	50 DC
25	G. E. NEW	220/440 AC	125 DC
20	Whse.	220/440 AC	250 DC
20	Cr. Wheeler	220/440 AC	180 cycles
15	Gen. Elec.	220/440 AC	125 DC
10	Allis Ch. (2)	220/440 AC	250 DC

*Synch. motor drive.

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
150	Cr. Wheeler b.b.	TEFC	230	800
100	Whse.	SK181	230	50/900
100	Gen. Elec.	C	230	575/1000
75	G.E. New b.b. (2)	CDM	230	1735
75	Cr.W. New b.b.(3)	CMC	230	1150
75	Allis Ch.	E	230	500
75	Whse.	813L	115	570
75	Gen. Elec.	BRC	115	1150
75	North w'n.	K30	230	1750
60	Elec. Dyn.	25-S	230	450/900
60	Whse.	SK	230	1700
50	Reliance	262T	230	1100
40	Sprague dyna.	LC	230	750/2000
40	Whse.	SK133	230	850
35/50	Gen. Elec.	CD123	230	575/1150
35	Ideal (2)	DV350	230	400/1200
30	Whse.	S-7	115	900
30	Gen. Elec.	RC31B	230	1150
25	Gen. Elec.	RC31	230	1150
25	Sprague dyna.	LC	230	750/2000
25	Chand'son(4)	C13	115	850
25	G.E. b.b. NEW	CDM93	115	1150
25	Gen. Elec.	CD85	230	1750
20	Gen. Elec.	RF12	230	400/1800
20	Whse.	SK93	230	1150
20	G.E. b.b. NEW	CDM83	115	1750
20	Gen. Elec.	RC11	115	1150
20	Reliance	T	230	850
20	Gen. Elec.	DLC	230	500/1500
20	Gen. Elec.	CD85	230	1150
15	Gen. Elec.	LC	230	550/1100
15	Roth	35RS	230	1750
15	G.E. b.b. NEW	CDM67	115	1750
15	Gen. Elec.	RC10	230	1150
15	Whse.(5)	SK90	230	825
15	El. Dyn. b.b. (2)	326	230	1750

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
150	Cr. Wheeler b.b.	TEFC	250	1200
175	Century b.b.	1500a	70	1200
100	Gen. Elec.	RC17	125	1200
100	Gen. Elec.	C	250	750
75	Allis Ch	E	250	750
75	Whse.	S	125	600
75	Cr. Wheeler b.b.	CCD	250	145
50	Reliance	T	250	1200
40	Whse.	SK	250	1150
30	Elec. Prod.	BB	50	1150
30	Gen. Elec.	RC	250	1500
30	Ideal 3 wire	HHR	125/250	850
25	G.E. NEW b.b.	CD93	125	1450
24	Whse.	SK	600	850
20	Reliance	T	250	1150

EXPLOSION PROOF MOTORS

from 1 to 20 H.P.....std. speeds

Turbo-Generator Bargain!
375KVA Whse. 3/60/240/480V. Non-Cond.

A. C. MOTORS—25 CYCLE

H.P.	Mfr.	Type	Volts	Speed
150	Whse.	HF	440	500
150	Gen. Elec.	IK-16	440	750
50	Allis Ch.	ANY	440	750
50	G.E. int.	MTC5337	440	750
50	G.E.	I-K	440	750

A. C. GENERATORS—60 CYCLE

KVA	Mfr.	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
500	Allis Ch.	3 brg.	240/480	360
375	Whse.	G	240/480	900
250	Whse.	G	2300	600
200	Gen. Elec.	ATB	240/480	600
156	G.E. 1 brg.	ATB7558	240/480	1200
150	Gen. Elec.	ATB	240/480	600
125	Whse.	G	240/480	720
125	Gen. Elec.	ATB	240/480	900
125	Gen. Elec.	ATB	240/480	300
100	Whse.	G	2300	900
100	Gen. Elec.	ATB	240/480	1200
62	El. Machy.	180 cy.	240/480	1800
56	Gen. Elec.	ATB	240/480	900
50	Cont. b.b.	S107	120/208	1200
25	Whse. b.b.	1 ph.	120/240	900
12½	Whse. b.b. NEW		240	1200

A. C. MOTORS—SLIP RING

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	600	Gen. Elec.	I-M	360
1—	450	Whse. 2200 V.	CW	600
2—	300	Allis Ch. 2200 V.	ANY	720
1—	300	G.E. 2200 V.	I-M	1800
1—	150	Whse.	HF13AH	720
1—	150	G.E. 2200/4000 V.	I-M	1200
1—	150	G.E. int. duty	ITC-15	720
1—	150	Allis Ch.	ANY	600
1—	125	Gen. Elec.	IM-15	720
1—	100	Allis Ch.	ANY	1800
1—	100	Al. Ch. b.b. NEW	ARY	600
1—	100	Allis Ch.	ANY	720
1—	100	Whse. int. 2200 V.	C1856C	600
1—	100	Gen. Elec.	MT 556	900
2—	75	Gen. Elec.	IM-14	720
1—	75	G.E. int. duty	MTC836	900
1—	75	Ideal int.	AVE	1200
1—	75	Gen. Elec.	MT558	600
2—	75	Gen. Elec.	IN-14	800
1—	75	Gen. Elec.	MT337	1800
2—	50	Allis Ch.	ANY	900
1—	50	Howell	SR437	1200
1—	50	Fair. Morse	BV	720
1—	50	Gen. Elec. int.	ITC	600
1—	50	Whse. int.	C1	600
1—	50	Gen. Elec.	I-M	720
1—	40	Gen. Elec.	MT336	900
1—	40	Gen. Elec.	MT327	1800
1—	37	G.E. int.	ITC	600
1—	30	Gen. Elec.	OMT336	1200
1—	30	Gen. Elec.	MT346	600
2—	25	Gen. Elec.	MT332	900
1—	25	Triumph	SR	1200
1—	25	Gen. Elec.	I-M	600
1—	20	G.E. int.	MTC5312	900
1—	20	G.E. b.b.	MT503	1800
2—	20	G.E. int.	MTC5302	1200
1—	15	Gen. Elec.	MT502	1200
1—	15	P & H b.b. int.	W7	1200

A. C. MOTORS—SYNCHRONOUS

H.P.	Mfr.	Type	Volts	Speed
667	Gen. Elec. .8 PF	ATI	2200	450
450	Whse.		220/440	900
300	Whse.	G	2200/440	600
225	Ideal	2BC-M4	2200	450
220	G.E. 3 brg. .8 PF	ATI	220/440	600
150	Gen. Elec. .8 PF	ATI	2200	450
150	Gen. Elec.	ATI	220/440	300
150	Gen. Elec.	ATI	220/440	600
125	Whse.	G	2300	900
125	G.E. splprf. .8 PF	TS955	220/440	1200
125	American b.b	YGH	220/440	900
100	Gen. Elec.	ATI	240/440	900
60	Gen. Elec..	ATI	220/440	900

A. C. MOTORS—SQUIRREL CAGE

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	300	Gen. Elec.	IK-14	1200
1—	200	Reliance b.b. NEW	C6085	1200
2—	200	Reliance b.b. NEW	C6085	1800
1—	200	Allis Ch.	AN	1200
1—	200	L. Allis 2200/3800 V.	OGK-144	900
1—	150	Allis Ch. 2200 V.	b.b.	720
1—	150	Reliance b.b. NEW	14C6085	720
1—	150	Whse. 2200 V.	C8771-1C	1800
1—	150	Reliance b.b. NEW	B6085	1200
1—	150	Reliance b.b. encl.	AA	900
1—	125	Reliance b.b. NEW	C6085	1200
2—	125	Allis Ch. 2200 V.	AN	1200
1—	125	Gen. Elec.	IK-16	450
1—	125	Cont. 2200 V. b.b.	SC	1800
2—	125	Rel. TFEC NEW	B6085	1800
1—	100	Gen. Elec.	I-K	900
4—	100	Allis Ch. 2200 V.	AR226	1200
1—	100	Reliance b.b. NEW	C6085	900
1—	100	Elec. Machy.	b.b.	1200
1—	100	Rel. TEFC NEW	C5085	1200
1—	100	G.E. b.b. NEW	K5048	1800
1—	100	Cont. TEFC	NP682	1200
1—	75	Reliance b.b. NEW	C5084	900
1—	75	Reliance TEFC NEW	C5084	1200
1—	75	Reliance b.b. NEW	C506	1800
1—	75	Gen. Elec.	KT329Y	3600
1—	75	Whse. hitorq	CS-607	1200
2—	75	Reliance b.b. NEW	C505	1200
1—	60	Gen. Elec.	KT 346	900
2—	60	Reliance b.b. NEW	B504	1800
2—	60	Rel. TEFC NEW	C505	1200
2—	60	Reliance b.b. NEW	C504	1200
2—	60	Whse. H. T.	CS504	1800
1—	60	Wagner b.b.	RP444	3600
1—	60	Allis Ch. 4000/2200 V.	AR823	1800
1—	50	Whse. b.b. NEW	CS4053	1800
1—	50	G.E. 2 phase	I-Q	900
2—	50	G.E. NEW b.b. HT	KG405	1800
2—	50	Reliance b.b. NEW	C445	1200
2—	50	Gen. Elec.	KT336	1200
1—	50	Gen. Elec.	KT342	900
2—	50	Whse. hislip	WL807	900
1—	40	Al. Ch. 3 speed	ARX	900/600/450
5—	40	Gen. Elec.	KT336	900
2—	40	Reliance b.b. NEW	C404	1800
2—	40	Rel. TEFC NEW	C445	1200
3—	40	G.E.	KT532	1200
2—	35	Gen. Elec.	I-K	720
2—	30	Howell b.b. speed	SC	1800
2—	30	G.E. NEW b.b.	K365	1800
2—	30	G.E. NEW hitorq	KG365	1800
2—	30	G.E. TEFC b.b.	K404	1800
1—	30	Gen. Elec.	I-K	900
1—	30	Gen. Elec.	KT336	720
1—	30	Wagner	22T8P	900
1—	30	Whse.	C3646	900
2—	30	Reliance b.b. NEW	C405	1200
2—	30	Reliance TEFC NEW	C446	1200
3—	30	Cr. Wheeler b.b.	SC 30Y	1800
2—	25	Rel. TEFC NEW	C444	900
3—	25	Reliance b.b. NEW	C364	1800
2—	25	Reliance TTFC NEW	B365	1800
2—	25	Reliance b.b. NEW	C404	1200
2—	25	Reliance TEFC NEW	C405	1200
2—	25	Whse. NEW spl. b.b.	CS365	1800
1—	25	Gen. Elec.	IK	1200
3—	25	Whse.	CS646	900
2—	25	Gen. Elec.	I-K	900
1—	20	Reliance b.b. NEW	C404	900
1—	20	G.E. TEFC b.b.	K404	1200
4—	20	Reliance b.b. NEW	C364	1800
2—	20	L.A. NEW exp. prf.	EX364	1800
2—	20	Whse. NEW b.b. spl.	CS364	1800
2—	20	Gen. Elec.	KT312	1200
1—	20	Whse.	CS	1200
2—	20	G.E. NEW b.b.	K365	1200
2—	20	Diehl TEFC NEW	INF364	1800
2—	20	Century b.b. 4 speed	SC594	1800
2—	15	Whse. Splashprf.	C3365	1200
4—	15	G.E. NEW b.b.	K324	3600
2—	15	Whse. NEW TEFC	CS326	1800
1—	15	Diehl TEFC NEW	INF365	1200
1—	15	Gen. Elec.	KT312	900
1—	15	L. Allis	OX365	900

ARTHUR WAGNER COMPANY

1435-37 W. RANDOLPH STREET CHICAGO 7, ILL. MONroe 7409

GLOW

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
750	900	6600	Westgh.
350	514	440	GE-I
300	900	440	GE-I
250	600	2300	Triumph
200	490	2200	GE
200	600	440	Westgh.-CS
150	600	2200	GE
125	1200	440	Century
100	1800	2300	Burke
100	1200	440	C-W
85	3600	2200	GE
75	900	2300	GE
75	720	2300	Wagner
60	3600	2300	GE-KT
60	1800	440	Al. Ch.
60	1800	2300	GE-FTR
50	3600	440	R. & M.
50	1800	220	GE-KT
50	900	220	GE
50	720	2300	Wtg.-CS
40	1200	220	GE-KT
40	900	2300	Wtg.-CS
40	900	220	Lincoln
40	720	440	GE-KT
33	900	220	GE-KT
30	1800	dual	Deleo
30	1200	dual	Master
30	720	220	GE-HI
30	514	440	Stanley
25	3600	dual	L-A
25	1800	dual	GE
25	1200	220	Wesche
25	900	440	GE
25	900	220	GE-FTR
25	720	220	Wagner
22	600	440	GE-I
20	3600	dual	GE
20*	1800	220/440	Master
20*	1800	220/440	Wesche
20	1200	440	Al. Ch.
20	900	440	Wtg.-CCL
15	3600	220	GE-KT
15	1800	220	W-E
15*	1800	220/440	Master
15	1200	220	Ridgeway
13	900	220/440	Westgh.-CS
15	600	220	Burke

ENCLOSED SQUIRREL CAGE

HP	RPM	Volts	Make
125*	1200	440	GE-TE-FC-BB
60	900	440	GE-TE-FC-BB
30	1800	dual	Deleo
30	1200	440	Wagner
30	900	440	Reliance, TE-FC-BB
20	1200	440	Wagner
20	900	440	GE-TE-FC-BB
15	1800	dual	Deleo
15	1200	220/440	Deleo-TEFC-BB
15	900	440	GE, TE-FC-BB
10	1200	440	GE-TE-FC-BB
7½*	1800	dual	Wagner-TEFC-BB
7½*	1800	dual	Master-TEFC-BB
7½	1200	dual	GE-Hi Slip-TEFC-BB
7½	1200	dual	Deleo
7½	900	dual	Deleo-TEFC-BB
5	3600	dual	Deleo-TE-FC-BB
5*	1800	dual	Master-TEFC-BB
5	1800	220	Wagner TE-BB
5*	1200	dual	GE-TEFC-BB
3	3600	dual	Deleo, TE-FC-BB
3	1800	dual	Deleo-TEFC-BB

*New Mat or

ENCLOSED SQUIRREL CAGE—Cont'd.

HP	RPM	Volts	Make
3	1200	dual	Rel-TEFC-BB
3	900	dual	Deleo
2	1800	dual	Deleo-TEFC-BB
2	1200	220	GE-TE-BB
2	900	220	Wagner-TE-BB
1½	900	dual	Deleo-TEFC-BB
1½	1800	dual	L. A.-TE-BB
1½	1200	dual	Ref-TE-BB
1	3600	220	Hankins-TEFC
1	1800	dual	Master-TEFC-BB
1*	1800	dual	Deleo-TE-BB
1*	1200	dual	Rel-TE-BB
¾	3600	4400	Deleo-TE
¾	1800	dual	Wesche-TE-BB
½	3600	220	Ohio-TE-BB
½	1800	440	Wtg.-TE-BB
½	1800	440	Deleo-TE-BB
½	1800	dual	Deleo-TE-BB
½	1200	220	Cr. Wh.-TE
½	900	dual	Deleo
½	3600	dual	Deleo
½	1800	dual	Deleo

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg.
400	1200	2300	Al. Ch.
400	514	4600	Al. Ch.
375	1800	2300	Al. Ch.
350	900	2300	Westgh.
250	300	2300	Al. Ch.
235	1800	220	GE-I
200	900	220	GE-I
75	1800	220	GE
60	1800	dual	Al. Ch.
60	900	2300	Burke
60	900	220	Wesche
50	1800	220	GE-MT
50	900	2300	Ridgeway
50	900	440	Wagner
50	720	440	Al. Ch.
40	1200	220	GE-MT-336
40	900	220	Wtg.-HF
40	720	2300	Wtg.-HF
40	720	220	Al. Ch.-ARY
40	600	2300	Al. Ch.-ARY
40	600	220	Al. Ch.-ARY
40	450	220	Triumph-C
35	1200	220	Westgh.
35	900	220	Al. Ch.
35	900	2300	Ridgeway
35	720	220	GE
35	900	2200	GE
30	1800	2300	Wtg.-CW
30	1800	220	GE
30	1200	440	Wagner
30	1200	2300	Lincoln
30	900	220	GE-MT
30	900	2300	F-M
30	720	220	GE-I
30	600	220	F. Morse-BV
25	1200	220/440	Watson-KB
25	600	220	Watson

VERTICAL MOTORS

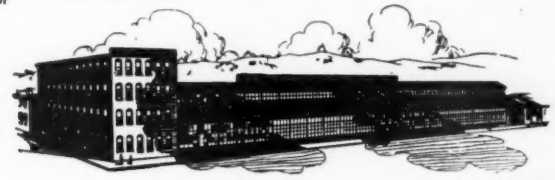
HP	RPM	Volts	Make
200	1200	440	Al. Ch.-SR
150	1200	2200	GE-I-SR
150	1200	440	GE-Cage

VERTICAL MOTORS—Cont'd

HP	RPM	Volts	Make
125	1200	2300	Al. Ch.-Cage
100	1200	440	GE-Cage
75	1200	2200	GE-Cage
75	360	220	Ideal-Cage
60	1800	230 D.C.	GE
60*	1200	440	Al. Ch.-Cage
50	1200	2200	Wtg.-Cage
50	600	440	Al. Ch.-Cage
40	1800	220	GE-Cage
40	1700	230 D.C.	GE
40	1200	440	Wtg.-SR
35	1800	440	GE-Cage
35	1200	2300	Al. Ch.-Cage
35	450	440	GE-Cage
30	1200	dual	Wtg.-Cage
25*	1550	220 D.C.	GE
25	1200	2200	GE-Cage
25	850	230 D.C.	Wtg.
20*	1800	440	Al. Ch.
20*	1200	440	Al. Ch.-Cage
15*	1800	440	Al. Ch.-Cage
15	1750	110 D.C.	Wtg.
15	1150	230 D.C.	GE
15	600	440	Al.-Ch.
12½	900	220	L. Al.-Cage
10	3400	230 D.C.	Wtg.
7½	1800	500 D.C.	Peerless
7½	900	440	Burke
7½	700	230 D.C.	GE
6	850	110 D.C.	Rel.
5	1400	230 D.C.	R. & M.
5	600	440	GE-Cage
4	1650	110 D.C.	Watson
3	1700	230 D.C.	Watson
3	1200	dual	Wtg.-Cage

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
3000	720	4800	GE-ATI
1015	500	2200	Wtg.-25 cycle
710	720	13200/6600	GE
250	720	440	GE-AT...
250	225	2200	GE-TS
220	600	2300	GE-ATI
200	720	440	GE-TS
200	225	2200	Wtg., rotor & stator
180	600	440	GE-ATI
150	720	440	Westgh.
118	164	208	GE
95	1200	220	Burke
75	1200	220	Westgh.
60	360	2200	GE, rotor & stator
50	1200	440	Wagner
50	900	220/440	Westgh.
50	720	440	GE-TS
50	360	440	GE, rotor & stator
30	900	440	Wagner
30	600	550	GE, rotor & stator
30	450	dual	Wtg., rotor & stator
30	360	550	GE
30	327	220	E-M, rotor & stator
25	1800	220	Wagner
25	450	220	E-M, rotor & stator
25	300	220	Ideal
20	1200	440	Wagner
20	900	220	Wtg.
20	600	220	E-M, rotor & stator
15	1800	220	Wagner
10	1800	220	Wagner
10	1200	220	Wagner
7½	1200	410	Wagner



AIR COMPRESSORS

2—Worthington, 11x12, horizontal, 328 CFM at 270 RPM Air Compressors, 100 lbs. pressure with or without motor.

1—Worthington, Feather Valve, 8½x9, horizontal, 170 CFM at 300 RPM Air Compressor, 100 lbs. pressure with or without motor.

D. C. MOTORS
115 Volts

HP	RPM	Description
225	750	GE-MPC
60	1200	Star
35	975	Northern
30	1800	F-M
30	200/600	Sprague
25	1150	Triumph
25	750	GE
20	700	Triumph
20	500/1500	GE-RF11
20	400/1200	GE-RLC fr. 202A
15	1200	J. & L.
13	975	F-M
15	725	Westgh.-S fr. 6
10	650	J. & L. type CI
28	600	Sturtevant MP8
15	1000	GE-CE
12½	1150	GE-RC29
12	1075	J.&L.
12	550	Westgh-SK113
10	3450	Imperial
10	1800/3400	Star, SB-5
10	1200	J.&L.-CF
10	1200/1800	Reliance TNT
10	400/600	Watson-BW15B

D. C. GENERATORS
125 Volts

KW	RPM	Description
500	750	GE-MCF
300	1500	GE-CC
200	900	GE-MPC
200	800	GE-DMC
100	1000	WE-DLC
100	900	C-W-CCD
80	400	J. & L.-G
165	1100	W-E, type ELC-7
155	1000	GE-Type TD
135	1165	GE-DLC
31.25	1400	Westgh.-SK-single bearing

D. C. GENERATORS—Cont'd.

30	1200	Al. Ch., single bearing
25	1200	Westgh.-SK, single bearing
25	1100	GE-CI.
25	600	Al.-Ch.-E-127
15	3600	GE-BF
15	1500	R. & M.
15	1100	Al. Ch.
15	725	Electro Dynamic, single bearing
13	780	Burke-AM3
10*	1750	Westgh.-SK-43
9	1050	GE-ML
5	1000	W-E (GE)-CD
5	750	GE-RC

D. C. GENERATORS
230 Volts

KW	RPM	Description
400	1200	Westgh.
200	1200	GE-MPC
200	375	J. & L.-type K
175	450	Westgh.
125	1400	Westgh.-SK-1301
80	1050	GE-DLC
75	700	Allis-Chalmers-E180
50	1200	Al. Ch.-E-127
35	1800	GE-RC
30	900	Electro Dynamic-158
30	300	Triumph
22½	765	Westgh.-SK
18	300	Burke
15	350	Westgh.-SK

ELECTRIC CO

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC EQUIPMENT
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

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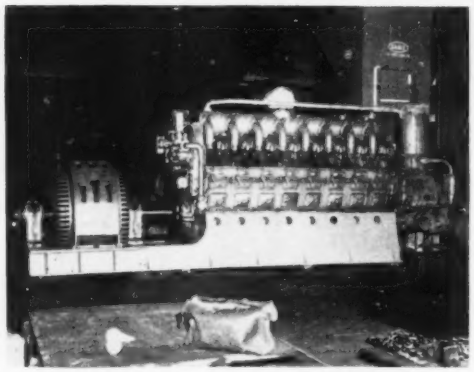
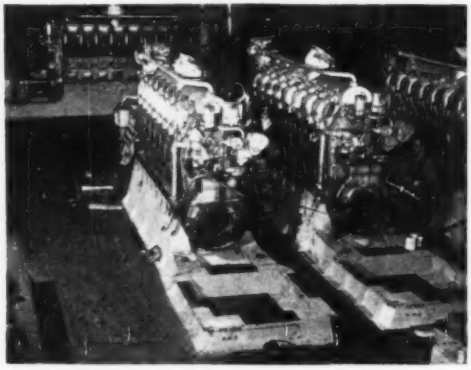
PHONE MA. 3024
CINCINNATI 3, OHIO



THIS IS THE FIRST OF FIVE DIESEL GENERATORS

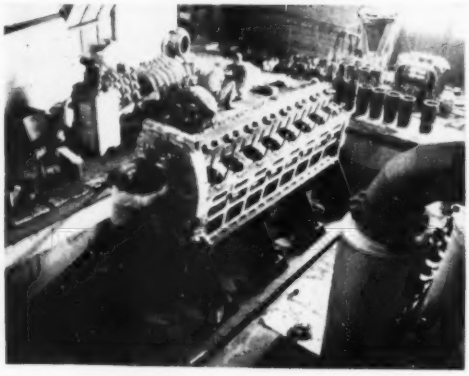
1600 H.P. General Motors, model 16-278-A, 16 Cylinder Diesel Engine, bore ¾", stroke 10½", R.P.M.—720—direct connected to—New 1250 K.V.A. Ideal Electric & Manufacturing Co Generator, 2400 volts, 3 phase, 60 cycle A.C. at .8 p.f. Belted exciter—New 10 K.W. Ideal Elec. & Mfg. Co.

SHIPPED IN THE PAST 30 DAYS TO A MIDWESTERN UTILITY



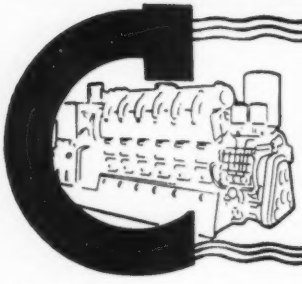
FOUR SIMILAR UNITS NOW BEING PREPARED FOR THE SAME PURCHASER AS PART OF A "CUSAC ENGINEERED" INSTALLATION

FIVE ADDITIONAL UNITS, SAME AS SHOWN, ARE NOW AVAILABLE.



ACTUAL PHOTO. REBUILDING INSTALLATION OF A "CUSAC ENGINEERED" UNIT ON ITS FOUNDATION FOR A WISCONSIN UTILITY. (This installation has been recently completed.)

"Cusac Engineered" means a complete, competent, dependable engineering service—from purchase of equipment to final approval. Cusac installations carry a new machine guarantee and are backed with a performance bond.



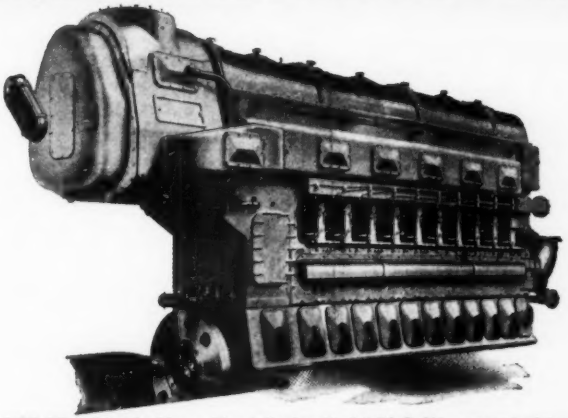
F. L. CUSAC *and Associates Inc.*

DIESELS

Webster 9-4180

BOARD of TRADE BLDG. — — CHICAGO

LIQUIDATION SALE—Modern Equipment



1600 HP Fairbanks Morse Diesel Engine Model 38 D 8⅛ opposed piston

CONDENSERS

(Most are new)

No.	Sq. Ft.	Make	Passes	Tubes	
4	3300	Str. Wells	2	Alu-Brass	¾"
1	2200	Alco	2	Cu Ni	⅝"
4	1050	Conseco	2	Cu Ni	⅝"
1	750	Bethlehem	2	Brass	⅝"
30	400	All. Chalm	2	Brass	⅝"
4	300	Wheeler	2	Cu Ni	
8	155	Conseco	2	Brass	¾"
44	349	Luboil Coolers		Cu Ni	⅝"

BOILERS

10—Cleaver-Brooks, 2000# steam pr. hr. 35# press.
3—Cyclotherm 3000 pounds steam per hour, 125# press.
6—Express Boilers, modified D type, Foster Wheeler 30,000# steam/hr., 435#.
2—Type "D", water tube, Foster Wheeler, 15000# steam/hr., 275#.

DISTILLING PLANTS

10—2000 gals. per day Kleinschmidt vapor compression distiller mfd. by Badger.
1—750 gals. per day, same as above.

BLOWERS—AIR PUMPS

8—Blowers, Roots Connersville, size 16x18, serial No. 14862, capacity 5000 CFM against 6 lb. sq. in. ga. pressure or 3450 CFM when creating 20" Hg vacuum, with 200 HP motors 3/60/2200 (mfd. 1942). Also available: 1 R.C. Blower, size 20 x 23 with 350 HP motor.
1—Air Pump, Ingersoll Rand, type FS546, 5500 CFM, discharge press. 24.22 abs., intake press. 20.61 abs., with 125 HP motor 3/60/2300 (mfd. 1942).
1—Air Pump, Ingersoll Rand, type FS548, 6690 CFM, discharge press. 20.86 abs., intake press. 17.10 abs., with 150 HP motor 3/60/2300 (mfd. 1942).
1—Blower, Buffalo, size 60, type R, with 150 HP motor 3/60/2200.
4—Vacuum pumps, Nash Hytor, size MD574, with 2 HP motors 230V DC (mfd. 1944).

AXIAL FLOW FANS

12,000 CFM, 3" S.P. 3/60/450 Sturtevant
10,000 CFM, 3" S.P. 3/60/450 Clarage
5,000 CFM, 3" S.P. 3/60/450 La Del
35,000 CFM, 1" S.P. 230V. D.C. Wing
Rugged construction, acid resisting vanes, totally enclosed motors, all NEW

DIESEL ENGINES

HP	MAKE	MODEL	RPM	CYCLE	YEAR
1800	General Motors	16-258S	750	4	1943
1600	Fairbanks Morse	38D O/P	720	2	1944
1600	Hamilton	RB99-D.A.	700	2	1944
1600	General Motors	16-278A	720	2	1944
1200	General Motors	12-278A	750	2	1944
900	General Motors	12-567ATL	750	2	1942/44
500	Superior	6-cyl.	514	4	
300	Fairbanks Morse	38-O/P	1200	2	1936
225	Gray Marine	4½" x 5"	2100	2	1943
150	Superior	GDB-8	1200	4	1942/44

DIESEL GENERATOR SETS

AC	200 KW	3/60/450	1200 RPM	General Motors	8-268A	1943 rebuilt
	100 KW	3/60/450	1200 RPM	General Motors	3-268A	1943 rebuilt
DC	1200 KW	525V	750 RPM	General Motors	16-278A	1943
	650 KW	240V	750 RPM	General Motors	12-567	1943
	125 KW	120/240	600 RPM	Superior	VDMB	
	100 KW	120/240	1200 RPM	Superior	GDB-8	1942/44
	100 KW	120/240	1200 RPM	General Motors	3-268A	1943/44
	10 KW	120	1200 RPM	Hercules	DOOD	1943

SPECIAL

30 Brand New Surface Condensers 400 sq. ft., 2 pass, 408 straight tubes, ⅝" OD, steam condensed: 6400 lbs., mfd. by Allis Chalmers.

MOTORS

3 Ph. 60 Cy.
6—3800 HP 1700 V 257 RPM G.E
5— 700 HP 2300 V 128 RPM
D.C.
1500 HP 525 V DC 600 RPM W'hse.
667 HP 374 V DC 1300 RPM Elliott
444 HP 250 V DC 900 RPM Elliott
222 HP 230 V DC 3050 RPM W'hse.

GENERATORS

1200 KW 525 V DC 750 RPM All. Chalm
1075 KW 375 V DC 750 RPM Elliott
700 KW 240 V DC 500/720 Elliott

TURBO-GENERATORS—A.C.

1—1000 KW All. Chalmers 3/60/600, 3600 RPM, cond., 140# steam press.
2—250 KW G.E. type AT1 3/60/450, 1200 RPM, cond.
2—200 KW Westinghouse, 3/60/450, 1200 RPM cond. (NEW).
6—200 KW G.E. type ATB 3/60/450, 1200 RPM cond. and non-cond.
2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

TURBO-GENERATORS—D.C.

KW	Volts	Winding	Speed	Type
2—375	180/240	Shunt.	1200	non-cond.
5—300	120	Compd.	1200	cond.
1—300	120/240	Compd.	1200	cond.
2—250	240	Compd.	1200	cond.
12—150	120	Shunt.	1200	cond.
12— 60	120	Stab. Sh.	1800	cond.
3— 25	120	Stab. Sh.	1200	cond.

FIRE PUMPS

2—1000 GPM, 280 ft. head, bronze, 6" x 5", Allis Chalmers, driven by Hercules Diesels, model DWXDS, 90 HP at 1800 RPM.
30—500 GPM, 120# press. at 2450 RPM. 750 GPM, 200# press. at 2900 RPM. with 160 HP White gasoline motor, 8 cycle, L-head type or 110 HP Cadillac, type V-8 (engines for sale separately).

ICE PLANTS (New)

2—22 ton capacity, Freon 12, mfd. by Frick.

HOISTS

10—100,000# pull at 10 FPM to 3000# pull at 400 FPM. 2 Gypsies 12000# pull at 125 FPM, driven by 50 HP 230v. D.C. motors 525—1800 RPM.
15—15,000# pull at 78 FPM, 3360# pull at 348 FPM and 2 auxiliary drums. Driven by Chrysler 28.35 H.P. gasoline engines. (NEW).

WRITE OR CALL FOR DETAILS

HUGO NEU CORPORATION
31 Nassau Street New York 5, N. Y.
Tel. REctor 2-1334

ARRANGE FOR INSPECTION

"BREW, WOLTMAN OFFERS"

TURBINE UNITS

1— 9375 KVA Cond. 50 cy. 13800 V. 600-lb. 825 deg. FTT. With surface condenser & boiler. NEW.
1—12500 KVA West. Cond. 25 cy. 600 V. 200-lb.
1— 5000 KVA G.E. Non-C. 60 cy. 13200 V. 600-lb.
1— 3750 KVA West. Cond. 60 cy. 2300 V. 200-lb.
1— 3125 KVA G.E. Cond. 60 cy. 2300 V. 200-lb.
1— 2500 KVA G.E. Cond. 60 cy. 2300 V. 200-lb.
1— 1563 KVA G.E. Extraction 60 cy. 2300 V. 400-lb. extraction 160-lb. Cond.
1— 1250 KVA DeLaval Non-C. 60 cy. 2300 V. 250-lb.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 200-lb.
1— 1250 KVA G.E. Non-C. 60 cy. 480 V. 400-lb.
1— 1250 KVA West. Non-C. 60 cy. 2300 V. 275-lb.
1— 937 KVA G.E. Cond. extraction 60 cy. 480 V. 375-lb.
2— 625 KVA G.E. Cond. extraction 60 cy. 480 V. 375-lb.
1— 625 KVA G.E. Non-C. 60 cy. 240 V. 175-lb.
1— 600 KVA Allis Cond. 60 cy. 480 V. 150-lb.

WATER TUBE BOILERS

2— 600 HP B. & W. 350-lb. Stokers
1— 919 HP Titusville 200-lb. Stoker
2— 509 HP B. & W. 200-lb. Stokers
1— 500 HP Union City 400-lb. Pulverizer
1— 418 HP Comb. Engr. 400-lb. Stoker
1— 180 HP Frost 200-lb. return tubular

STEAM ENGINE UNITS—60 Cy.

1— 1250 KVA Nordberg Uniflow, 480 V.
1— 450 KVA Ames Uniflow, 2300 V.
1— 400 KVA Skinner Uniflow, 480 V.
1— 312 KVA Skinner Uniflow.
1— 156 KVA Ames Vert. Uniflow, 240 V.
1— 150 KVA Ames Uniflow, 220 V.
1— 125 KVA Ames Uniflow, 2300 V.

D. C. STEAM ENGINE UNITS

2— 750 KW Skinner Uniflow 250 V.
1— 300 KW Skinner Uniflow 275 V.
1— 275 KW Ames Vertical Uniflow 250 V.
1— 200 KW Skinner Uniflow 250 V.
1— 200 KW Skinner Uniflow 125 V.
1— 100 KW Skinner Uniflow 230 V. 3-wire
1— 75 KW Ames Uniflow 125 V.

DIESEL ENGINE UNITS

2— 1600 HP Fair. Morse 60 cy. 2300 V. NEW gen.
1— 720 HP Amer. Loco. 240 V. DC
1— 625 HP Worth. 240 V. 60 cy. gen.
1— 600 HP Fair. Morse 2400 V. 60 cy.
1— 400 HP DeLaVergne 2400 V. 60 cy.
1— 375 HP Worth. 240 V. 60 cy. gen.
2— 240 HP Fair. Morse 2400 V. 60 cy.
1— 150 HP Gen. Motors 3-378A-60-3-480
2— 135 HP Murphy 240 V. 60 cy.

SYNCHRONOUS MOTORS—60 Cy.

2— 3000 HP G. E. 1700 V. 257 RPM
1— 2800 HP E. M. 2200 V. 225 RPM
1— 1400 HP G. E. 4150 V. 514 RPM
1— 880 HP G. E. 4600 V. 514 RPM
2— 500 HP E. M. 2200 V. 514 RPM
3— 400 HP E. M. 440 V. 600 RPM
1— 350 HP G. E. 4800 V. 225 RPM
1— 300 HP G. E. 2300 V. 600 RPM
1— 300 HP West. 2300 V. 900 RPM
4— 150 HP West. 2200 V. 400 RPM
1— 150 HP G. E. 2300 V. 600 RPM
1— 150 HP G. E. 4160 V. 600 RPM
2— 125 HP G. E. 2300 V. 900 RPM
1— 100 HP G. E. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

1— 5000 HP Cr. Wh. S/R 220 V. 895 RPM
1— 2200 HP S/R 11000 V. 750 RPM 25 cy.
1— 1200 HP Al. Ch. S/R 2200 V. 600 RPM
1— 1000 HP G. E. S/R 2200 V. 514 RPM
3— 350 HP Elliott S/C 2300 V. 900 RPM
1— 300 HP West. S/R 2200 V. 1770 RPM
1— 250 HP G. E. S/R 2200 V. 1800 RPM
3— 200 HP E. M. S/C 480 V. 1800 RPM
1— 200 HP G. E. S/R 2200 V. 435 RPM
1— 150 HP Cr. Wh. S/C 440 V. 1800 RPM
1— 150 HP Al. Ch. S/C 440 V. 1200 RPM

MOTOR GENERATOR SETS

1— 1500 KW Al. Ch. 600 V. DC 60 cy.
2— 1000 KW Gen. Elec. 600 V. DC 60 cy.
1— 1000 KW Gen. Elec. 250 V. DC 60 cy.
1— 800 KW Gen. Elec. 250 V. DC 60 cy.
1— 300 KW West. 250/125 V. DC 60 cy.
1— 400 KW Gen. Elec. 60 V. DC 60 cy.
1— 75 KW West. 125 V. DC 60 cy.
1— 75 KW Ridgway 115 V. DC 60 cy.
1— 75 KW Star 240 V. DC 60 cy.
1— 18 KW West. 60 V. DC 60 cy.

ROTARIES—60 Cy.

1— 2929/3705 KW Gen. Elec. 225/285 V.
1— 2025/2565 KW Gen. Elec. 225/285 V.
1— 2000 KW Allis Chalmers 600 V.
1— 1500 KW Westinghouse 600 V.
2— 1500 KW Westinghouse 270 V.
2— 1000 KW General Electric 600 V.
1— 750 KW Westinghouse 275 V.
1— 500 KW Allis Chalmers 600 V.
1— 500 KW General Electric 275 V.

FREQUENCY CHANGERS

1— 6250 KVA G. E. 50/60 cy. 600 RPM
2— 3000 KVA West. 25/60 cy. 300 RPM
1— 2500 KVA G. E. 25/60 cy. 300 RPM
2— 1000 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA Al. Ch. 25/60 cy. 300 RPM

TRANSFORMERS—60 Cy.

4— 7500 KVA Al. Ch. 33000-13800 V. 3 ph.
3— 667 KVA Pitts. 33000-11000 V.
3— 200 KVA West. 33000-2400 V.
3— 50 KVA G. E. 33000-2300 V.
3— 75 KVA Moloney 33000-2300/6900 V.
3— 3750 KVA West. 26400/13200—2400 V.
1— 8000 KVA Penn Auto 26400-13200/2400 V. 3 ph.
4— 450 KVA Al. Ch. 25410/44000-13280/23000 Y
3— 1667 KVA Wagner 2300-575 V. 25 cy.
2— 4000 KVA Penn. Furnace 22000-228 V. 3 ph.
6— 3000 KVA Al. Ch. Furnace 13200-200 V.
2— 200 KVA G. E. 11500-220/110 V.
3— 200 KVA Moloney 11000-2300 V.
3— 167 KVA G. E. 7200/12400 Y-240/480 V.
1— 1500 KVA West. Auto 4000-2300 V. 3 ph.
1— 100 KVA G. E. 2300-575 V. 3 ph.
3— 250 KVA Al. Ch. 2300-460 V.
3— 20 KVA West. 2200-575/287 V.
3— 7½ KVA G. E. 600-120/240 V.
12— 15 KVA Standard 450-117 Delta
2— 27½ KVA G. E. 440-220/110 V.

OIL CIRCUIT BREAKERS

2— 800 A. 87 KV Am. Brown Bov. Outdoor
1— 400 A. 37 KV West. G11 Outdoor
2— 400 A. 25 KV G.E. FK0136 Outdoor
2— 1000 A. 23 KV Kelman CB2 Outdoor
4— 600 A. 15 KV G. E. FHK0139BS Outdoor

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BREW, WOLTMAN & CO., INC.

50 Church Street — New York City 7 — New York

TRANSFORMERS

The following 3 transformers were used in one bank.

1—333 KVA. Gen. Elec., 33000 x 13200/6600
2—500 KVA. Pittsburgh 330 x 13200/6600

3—400 KVA. Gen. Elec. 13200 x 240
2—200 KVA. Packard 2300 x 115/230
3—150 KVA. Pittsburgh 2300 x 230/460
2—150 KVA. Pittsburgh 2300 x 115/230
4—100 KVA. Gen. Elec. 2300 x 115/230
Other sizes in stock in various voltages.

TURBO GENERATORS

1—500 KW., 3 ph., 60 cy., 440 volt to Gen. Elec. turbine #39937. With condenser switchboard etc. Very modern unit.

1—500 KW., 3 ph., 60 cy. Gen. Elec. non condensing.

1—750 KW., Gen. Elec. automatic extraction.

MOTOR GENERATORS

1—105 KW., 1500 amp., 70 volt to 150 HP., 3 ph., 220/440 volt, 1165 RPM, ball bearing Electric Products Co. set.

MOTOR GENERATORS (Cont'd)

1—1000 amp., 80 volt Burke with 3 ph. syn. motor.

1—75 KW., 250 volt, 1200 RPM., 3 ph., 60 cy., 440 volt syn. motor, Star Electric Co.

1—50 KW., 250 v., Louis Allis to 75 HP., 220/440 volt type 1-K Gen. Elec.

1—15 KW., 250 v. Westgh. SK to 3 ph., type CS motor.

MISCELLANEOUS

2—25 KVA., 1 ph., 60 cy., 120 or 240 v. Westgh. to 4 cylinder LeRoi engines, with panels.

1—150 KW., 125 volt Crocker Wheeler generator to 4 cylinder vertical Amos steam engine.

3—90 KVA., 3 ph., 60 cy., 440 volt Gen. Elec. Pyranol capacitors.

1—1080 HP., Gen. Motors Diesel Engine to 600 KW., 500 volt, 750 RPM. Westgh. generator.

All above equipment actually in stock. Send for our list of many other items we have.

KEYSTONE POWER PLANT EQUIPMENT CO.

8403 HEGERMAN STREET — HOLMESBURG, PHILADELPHIA 36, PA.

DIESEL UNITS

2—450 HP Fairbanks Morse 32E, 6 cyl. 300 RPM, 300 KW, 3/60/2300. New 1942.

1—600 HP Fairbanks Morse Model 33, 4 cyl. 400 KW, 257 RPM, 3/60/2400. Complete. Excellent.

2—450 HP Chic. Pneu. 257 RPM, 4 cyc. 300 KW, 3/60/2300. Westinghouse gen. Excellent.

MISSISSIPPI VALLEY EQUIPMENT CO.

507 Locust St. — St. Louis 1, Mo.

TRANSFORMERS

6—250 KVA. Westinghouse, 1 phase, 60 Cy., OISC., out-door, 22000/21450/21900/20350/19800 volts primary to 2300/4000Y volts secondary. (If connected for 11,000 volts primary there are taps to 10450/9900.) #1218021-1218022-1061478-79-80 & 83.

3—200 KVA., Gen. Elec., 1 ph., 60 Cy., OISC., out-door, 22000/21450/20900/20350/19800 volts primary to 2300 volts secondary. #2531471-2531472 & 2726448.

4—75 KVA. Gen. Elec., 1 ph., 60 Cy., Type H. Form KR., OISC., Out-door, 13200/12540/11850 volts primary to 440 volt secy., #4999501-03-05 & 07.

All the above transformers are ready for immediate delivery.

ARCHER & BALDWIN, INC.
(Inc. 1917)
75 West Street — New York City 6, N. Y.
Tel.—BOwling Green 9-9275—9276

MOTOR GENERATORS

500 KW G. E. Syn. 250 V. DC, 900 RPM, 440/2300/4000 6900 V. AC, 3 Ph., 60C

500 KW G. E. Syn. 600 V. DC, 900 RPM, 440/2300/4000 6900 V. AC, 3 Ph., 60C

400 KW West. Syn. 600 V. DC, 720 RPM, 2300/4000 V. AC, 3 Ph., 60 Cy.

300 KW G. E. Syn. 250 V. DC, 1200 RPM, 2300/4600 V. AC, 3 Ph., 60 Cy.

150 KW G. E. Syn. 250 V. DC, 1200 RPM, 2300/4000 V. AC, 3 Ph., 60 Cy.

SYNCH. CONVERTER

300 KW G. E. 600 V. 6 Ph., 60 Cy. 1200 RPM. 2300/4000/6900/13,200 V. Transf.

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK COMPANY

502 Grant Building, Pittsburgh, Pa.

FOR SALE

GAS ENGINE GENERATORS

3—375 KVA 60 cy 3 ph 440 volts Elliott Alternators Direct-connected to Ingersoll-Rand 400 RPM Gas engines—complete with exciters & switchboards. Can be rewound for 2300 volts. Running and in operation at this time.

INDEPENDENT ELECTRIC MCHY. CO.
300 SOUTHWEST BLVD.
KANSAS CITY 8, MISSOURI

TRANSFORMERS

FOR SALE

3— 3 KVA W-H 13200-120/240
12— 5 KVA W-H 13200-120/240
4— 10 KVA W-H 13200-120/240
1— 15 KVA W-H 13200-120/240
3— 25 KVA W-H 13200-120/240
3— 25 KVA Mol 13200-120/240
10—37½ KVA W-H 13200-120/240
2— 25 KVA W-H 13200-2400
2—37½ KVA Mol 13200-2400/4160Y
3— 75 KVA W-H 13200-120/240
3— 75 KVA G-E 13200-120/240
1— 75 KVA Mol 13200-2400
1— 100 KVA W-H 13200-2400
10— 1½ KVA Wag 7200-120/240 "REA"
2— 5 KVA G-E 4800-120/240
4— 5 KVA W-H 2400/4800-120/240
4— 7½ KVA W-H 4800/8320Y-120/240
1— 25 KVA Mol 2400/4800-120/240
3— 50 KVA W-H 4800/8320Y-120/240
3— 50 KVA G-E 26400-2300/4000Y
3— 50 KVA G-E 33000-2400/4160Y
3— 100 KVA G-E 33000-2400/4160Y
3— 200 KVA Pitts 26400-2300/4000Y

TRANSFORMERS

WANTED

Rewind and repair service on all makes of transformers.

THE ELECTRIC SERVICE CO.
Cincinnati 27, Ohio

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

PROMPT SHIPMENT—PARTIAL LISTING

SLIP RING MOTORS—3 Ph., 60 Cy.

Qu.	H.P.	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-5201
1	7½	575	220	G.E.	MT-522
2	10	1140	440	West.	HF-7A
2	10	570	220	G.E.	HI-11
2	11‡	810	550	G.E.	ITC-5008
2	15	1160	440	West.	CW-464C
2	15	570	220	West.	CW-646
1	15	1160	440	West.	NW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	850	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	1130	440	G.E.	MT-326
1	30	865	440	West.	CW-646
1	30	850	440	G.E.	MT-352
1	30	675	440	G.E.	MT-336
2	35	660	440	F-M	HV-H16A
2	40	865	2200	Al.-Ch.	ARY-223C
1	40	860	440	G.E.	MT-346
2	50	1150	440	G.E.	M-536
1	50	589	440	West.	HF-12A
1	50	570	440	G.E.	MT-552
5	52‡	580	220	G.E.	IQC-5013***
1	60	685	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	45	550	West.	CW
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTF-549
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
1	250**	298	220/ 380††	West	CW-20-53-15
3	300	900	140	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
1	300**	360	440	West.	CW-20-53-15
2	350	880	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	650**	360	440	G.E.	MT-442Y
1	700	735	4000‡‡	West.	CW

All 220 volt motors can be reconnected for 440 volts.
‡ Intermittent rating. *** 2 phase.
** New. †† 50 Cycle. ‡‡ 25 Cycle.

230 Volt Constant Speed D.C. Motors

On.	H.P.	Speed	Make	Type
22	2	850	West.	SK-20
20	3	1150	West.	SK-20
10	3	850	Reliance	Y-23T
25	3½	850	West.	SK-30
3	7½	1750/1310	West.	SK-43
2	7½	1150	G.E.	CDM-6e
3	7½	850	G.E.	CD-75
10	10**	1750	Kimble	BA-324
5	10**	1150	Al.-Ch.	EB-80
1	10	850	West.	SK-83
10	13½**	600	West.	SK-93
3	15	1750	G.E.	CD-75
5	15	825	West.	SK-90
1	20	1750	L.A.	LNA-L851
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-1101
17	25	825	West.	SK-120
2	30	1100	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	650	G.E.	RC-16
1	60	1750/1310	West.	SK-143
1	150	700	Al.-Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D.C. MOTORS

10	1½/2	500/200	G.E.	CD-65
1	2	225/900	Reliance	78T
1	5	450/1800	G.E.	CD-83
2	6	450/1800	G.E.	RF-9
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
1	12½	280/840	West.	SK-130
10	12½**	600	West.	SK-93
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20/25	400/1600	Reliance	T-250-T
1	20/25	300/1200	West.	SK-153
1	25	400/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
1	23/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	30/40**	400/1600	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	40/50	400/1600	Al.-Ch.	ED-147
1	75	500/1500	Cr.-Wh.	CCM
1	75	375/750	Cr.-Wh.	CMC-125H
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.-Ch.	
1	100	320/960	West.	SK-200
1	175	300/900	West.	SK-220
2	375	350/500	G.E.	MPC

** New.

VARIABLE VOLTAGE DRIVES

40 HP, Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Totally Enclosed Fan Cooled, Ball Bearing

On.	H.P.	RPM	Volts	Make	Type & Frame
2	½	1750	220	R&M (TE)	L-184
1	¾	1725	440	G.E.	K-63
4	1	1140	220	Howell	A-204
4	1.8	1150	220	L.A. (TE)	JS-225
5	1.5	1140	440	West.	CS-225
1	2	1735	220	G.E.	K-224
4	2	1140	220	L.A.	JS-225Y
1	2	1100	440	West.	CS-225
2	3	1160	440	L.A.	JS-254
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
10	5	1730	440	G.E.	K-254
1	5	1720	440	Century	SCH-254
2	5	1165	440	L.A.	JA-284
3	7.5	1740	440	G.E.	K-284
1	7.5	1735	220	G.E.	KF-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	10**	880	220	West.	CS-365-EXPF
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504

Splashproof, Ball Bearing

1	2	1735	440	G.E.	K-224
1	3	1160	440	L.A.	FS-254
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1150	440	L.A.	FX-365
3	30	3520	440	L.A.	FX-365S
2	40	1175	220	G.E.	K-445
3	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	125	1770	440	L.A.	FX-1078Y
1	150	1775	440	L.A.	FX-1168
3	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-633
1	200	885	440	L.A.	FS-1378

Open Type Motors

On.	H.P.	Speed	Volts	Make	Type
5	2	170	440	G.E.	KT-926
4	2	1160	440	West.	CS-93C
1	2	690	440	G.E.	KT-944
10	5	1740	440	West.	CS-232C
1	7½	3475	440	West.	CS
1	7½	1750	440	West.	CS-250C
3	7½	1165	440	G.E.	KT-952
2	7½	870	440	West.	CS-370C
5	10**	1760	440	L.A.	OGA-324
5	10**	1750	440	West.	CSP-324
3	10	1160	440	West.	CS-370C
1	10	865	440	G.E.	KT-502
1	15	3455	220	Reliance	AA-B3247
1	15**	1775	440	Century	SC326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RPI-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KF-512
2	20	900	220	G.E.	FTR-522
1	25	1800	220	G.E.	KT-512
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	SCRR-356***
2	25**	875	440	Master	PB-405
2	25	575	440	G.E.	KT-542
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3545	220	G.E.	KF-4048
2	40	1750	440	West.	CS-583C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
1	50	850	220	West.	CCL
2	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-546
1	75	1160	440	West.	CS-662C
1	75	870	220	West.	CS-766A
2	75	865	2300	G.E.	KT-552
1	100	690	220	West.	G
1	100	580	2200	G.E.	IK-18A
2	100	500	2200	West.	CS-880
1	100	495	2200	Al.-Ch.	AM
2	125	435	440	Al.-Ch.	AR
2	125	400	2300	G.E.	I-17-FR
1	200	880	550‡‡	G.E.	KT-5668
1	500	1200	440	G.E.	KTP-547
1	700	1800	2300/4000	West.	CS-4-39D-12

All 220 volt motors can be reconnected for 440 volts.
** New. *** 2 Phase.
‡‡ Reconnectable for 440 volts.

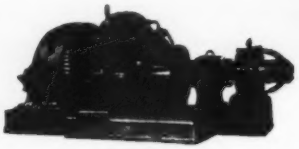
CRANE, MILL TYPE, 230 V. D.C. MOTORS

Qu.	H.P.	Speed	Make	Type
2 (115 v.)	3½	700	G.E.	CO-1805
2	5½	760	West.	MCB-20
1	6½	680	West.	K-3
1 (new)	6/ 7	1050/900	West.	K-7
1 (new)	10	690	G.E.	MD-403-BE
3	25	590	Diehl	TE
2	27½	535	West.	K-7
2	35	750	G.E.	CO-1828
3 (new)	35	600	West.	CK-9
1	50	750	G.E.	CO-1829A
1	50	600	West.	CK-9
4	50	525	G.E.	CO-1830
1	50	470	G.E.	CO-2007
2 (new)	60	550	G.E.	COM-1831 AE

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We Have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.
4521 HAMILTON AVE. CLEVELAND 14, OHIO

REBUILT BY CHICAGO ELECTRIC



Fine Items From One of The Nation's Largest Stocks Of Motor Generator Sets Check These Units For Service, Economy and Prompt Delivery

Special Offering

MOTOR GENERATOR SETS

1000 KW generator, General Electric type MPC, compound interpole, 275 volts, 514 RPM, direct connected to, 1120 KVA synchronous motor, General Electric, type TS, 3 phase, 60 cycle, 4600 volt, 514 RPM, on fabricated steel sub-base. Complete.

500 KW generator General Electric, type MPC, compound interpole, 250 volts, 720 RPM, direct connected to, 710 HP synchronous motor, General Electric, Type ATI 3 phase, 60 cycle, 440 volts, 720 RPM, 3 bearing unit, on fab. steel sub-base.

POWER FACTOR CORRECTOR

M.G. Set, consisting of 1563 KVA AC gen 3/60/2300 900 RPM and Syn. motor 3/60/2300 900 RPM.

STEAM ENGINES

300 KW Cr. Wheeler CCD 250 DC with Nordberg 22x32 Corliss 150# 375 KW A-C 3/60/480 22x42 hor. engine 125#.

BOILER

565 HP Springfield 160 lbs. NEW 1936 like new with Stokers, coal elev. bunker forced draft, blowers, etc.

TURBINE

312 KVA Cr. Wheeler 3/60/240 1200 RPM thru gear to Moore turbine 425 lbs. exh. 10#.

MOTOR-GENERATOR SETS

KW	Make	Volts AC	Volts DC
1250	Al. Chlrs.	4000	500/600
1200	Gen. Elec.	3/60/5000	125/250
1000	Gen. Elec.	3/25/2300	250
1000	Gen. Elec.	4150	250/275
500	Gen. Elec.	2300/4000	600
500	Gen. Elec.	440	250
450	Gen. Elec.	2300	125
350	G.E.	440/2300	250
350	G.E.	2400	250
300	Gen. Elec.	440/2300	250
300	Gen. Elec.	2400	250
200	Cr. Whlr.	2300	125
150	Al. Chlrs.	220	125
90	Gen. Elec.	2300	60
75	Star	220/440	230
75	Gen. Elec.	2300	125
75	Wstghse.	2300	110
75	Gen. Elec.	2300	250
60	Al. Chlrs.	2300	110
60	F. Morse	220	125
50	Wstghse	220	110
50	Cr. Whlr.	240	230
40	Cr. Whlr.	220	125
40	Wstghse.	220	125
40	Cr. Whlr.	440	125
35	Gen. Elec.	220	40
25	Wottoa	220	97/111
20	Bogue	220/440	125
15	Columbia	440	45
15	Wstghse.	220	250
10	Reliance	440	250
10	Cr. Whlr.	220	125
8	Hertzer	220	90/108
7½	Milwaukee	44	60
6	Gen. Elec.	220	230
5.25	Wstghse.	220	115
5	Cr. Whlr.	229	115
5	Ideal	220	115/230
5	Hertner	220	90/108

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	Speed
400	Gen. Elec.	K-9838	440	514
400	Wstghse.		2200	1750
350	Gen. Elec.		440	720
250	Gen. Elec.	I-K	2300	900
200	Allis Chlrs.	New	440	900
150	Gen. Elec.	KT	2300	600
125	Wstghse	CS-5048	220/440	3600
125	Gen. Elec.	TEFC	440	1200
100	Allis Chlrs.	AR	440	514
75	A.C.	AR	220/440	1800

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
3000	Gen. Elec.		2200	120
1500	Wstghse	HF	2200	240
800	Wstghse.	CW	6600	507
750	Gen. Elec.	MT16	2200	450
600	Gen. Elec.	IM	440	352
400	Wstghse.	CW	2200	450
400	A.C.	ANY	2300	514
400	Gen. Elec.	MT412	2300	450
300	Gen. Elec.	I-M	2200	1800
250	A.C.		2300	300
100	Wstghse	CW	440	600

SYNCHRONOUS MOTORS

HP	Make	Type	Volts	Speed
1500	Gen. Elec	ATI	4150	514
1000	Wstghse.		440	900
400	Wstghse.		2300	900
300	Gen. Elec	THB	2300	450
300	Allis Chlrs.		4000/2300	600
250	Allis Chlrs.		2200	720
210	El. Mach.		440	900
200	Allis Chlrs.		2200	360
150	Gen Elec.	TS	2200	900

Remember! This Is Only A Partial Listing From Our Large Quality Stocks. We can Furnish You With Almost Any Item in the Electrical Power Equipment Field . . . . And Then Some

CHICAGO ELECTRIC COMPANY

1320 WEST CERMAK ROAD — CHICAGO 8, ILL. — CANAL 2900

EMPIRE GUARANTEED POWER EQUIPMENT

FROM ½ TO 500 H.P.-A.C.-D.C. NEW AND REBUILT

• MOTORS • GENERATORS • M. G. SETS •

ONE OF THE LARGEST STOCKS OF ELECTRICAL EQUIPMENT ON THE EASTERN SEABOARD

MORE THAN 35,000 ITEMS OF ELECTRICAL MACHINERY CARRIED IN STOCK AT ALL TIMES AVAILABLE FOR IMMEDIATE SHIPMENT

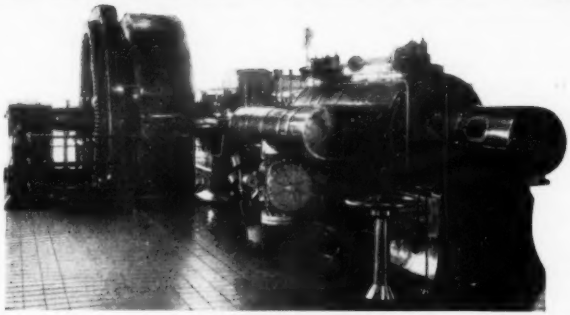
WIRE . . . . WRITE . . . . PHONE . . . . FOR *FREE STOCK LIST* AND QUOTATIONS. 3 CONVENIENT BROOKLYN WAREHOUSES

EMPIRE ELECTRIC CO., INC.

87-93 JAY STREET · BROOKLYN 1, N. Y.

TEL.- MAIN 4-6868

POWER PLANT MACHINERY



Actual Photograph

500 KVA SKINNER UNIFLOW ENGINE GENERATOR UNIT

500 KVA General Electric Generator, 3 phase, 60 cycle, 460/230 volts, 150 RPM, direct connected to Skinner Universal uniflow engine, 130-160# steam pressure, 0-5# back pressure. Excellent condition, can be shown in operation.

TURBO GENERATORS
3 phase 60 cycle

6000 KVA (2) G.E., 4160/2400 volts, 600# steam, condensing.
5000 KVA G.E., 13800 volts, 600# steam, 135# extraction, 25# exhaust.
2500 KVA (2) Westg., 2300 volts, 250/400# steam, 0-30# exhaust.

UNIFLOW UNITS
3 phase 60 cycle

1000 KVA Skinner, 480 volts, 175# steam, 5# exhaust.
750 KVA Skinner, 480 volts, 150# steam, 5# exhaust.
500 KVA Skinner, 450 volts, 130-160# steam, 0-5# exhaust.
250 KVA (2) Skinner, 450 volts, 110-175# steam, 0-5# exhaust.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO

POWER EQUIPMENT

INSPECTION INVITED

NORTHERN METAL COMPANY TOPS IN DEPENDABILITY

IMMEDIATE DELIVERY

DIESEL ENGINES

General Motos 900 HP Model 12-567, 2 cy. 12 cyl. 744 RPM with Falk reversing and reduction gear, ratio 2½ to 1. Electric starting. Auxiliaries available.

DIESEL GENERATORS

100 KW DC 240/120 V., 417 Amps., 1200 RPM. Motor: Superior, 150 HP Model GDB-8, 8 cyl., Electric Starting. Auxiliaries Available.

TURBO-GENERATORS

132 KW. AC, GENERAL ELECTRIC, Generator: 450 & 220 V, 3 Phase, 60 cycle, 1200 RPM. 275 Amps. Exciter: 40 KW. DC. 120 V. 22.6 Amps. Reduction Gear: 10071 to 1200 RPM. Turbine: 172 KW. Condensers available.

60 KW. DC. WESTINGHOUSE, Generator: 120 V. 1800 RPM. 500 Amps. Reduction Gear: 7283 to 1800 RPM. Turbine: 60 KW. 89.4 H.P. Condenser available.

NUMEROUS OTHER ITEMS ARE AVAILABLE FOR INDUSTRIAL USE.

FOR COMPLETE INFORMATION
WRITE PHONE

NORTHERN METAL CO.

MILNOR & BLEIGH STS. —SHIPBREAKERS— PHILA. 35, PA.

PHONE: MAfair 4-1400

MOTORS • GENERATORS • TRANSFORMERS

MOTORS
3 PHASE—25 CYCLE—220/440 VOLTS

H.P.	Make	Type	Frame	RPM
50	Fairbanks Morse	H16B	Ball Bearing	750
75	Fairbanks Morse	H16C	B.B. Slipring	750
75	Gen. Elect.	IK	2200 volt	750
75	Gen. Elect.	IK		1500
100	Allis Chalmers			1450
150	Gen. Elect.	IK-17		365
150	Gen. Elect.	IK-16		480
150	Gen. Elect.	1M-16	Slip Ring	480
150	Allis Chalmers			1450
150	Gen. Elect.	KT	557	1455
400	Gen. Elect.	1M 17A	Slip Ring	730
500	Gen. Elect.	IK		485
600	Gen. Elect.	MT	Slip Ring	490
600	Westinghouse	CS		490

NEW TRANSFORMERS

6—50 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—75 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—100 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—100 KVA Niagara O.I.S.C. 2400/120/240 1 Phase 60 cycle with taps.
2—150 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
6—200 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.

REBUILT TRANSFORMERS

Qu.	KVA	Make	Cycle	Voltage
3	15	Wagner	25	4400/240/480
3	50	Pitts.	25	11000/2300
2	50	Kuhlman	25	11500/2300/230/460
1	50	Kuhlman	25	11500/115/230
2	50	G. E.	60	2400/120/2400
1	100	G. E.	25	4600/230/460
3	400	Pitts.	25	12000/110

FREQUENCY CHANGERS
All Sizes in Stock, 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 and any other high cycle if desired.

HORIZONTAL & DUPLEX
Compressor & Vacuum Pumps after Coolers, Filters

25 CYCLE MOTORS

1—1270 HP. Gen. Elect. Synchronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.
1—1900 HP. Gen. Elect. Synchronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.

MOTOR GENERATOR SETS

2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP. 3 Phase 25 Cycle motors —Will rewind for 60 Cycle operation.

3000 CYCLE MOTOR GENERATOR SET

GENERATOR—175 KVA General Electric A.C. Generator, type A.S.C. form AL, single phase, 800 volts, 3000 cycle, 1800 RPM, serial #3513639.
GENERATOR EXCITER—1 KW. General Electric Generator, type EF, form EB, 125 volts, D.C., 1800 RPM, 8 amps., serial #1758709.
MOTOR—300 HP. General Electric synchronous motor, type TS, form EL, .8 P.F. 3 phase, 60 cycle, 440 volts, 1800 RPM, serial #3513638.
MOTOR EXCITER—3 KW. General Electric Generator, type EF, form EB, 125 volts, DC, 1800 RPM, 24 amps., serial #1758730.
Motor and Generator are direct connected, 4 bearing. Mounted on factory fabricated base, with direct connected exciters.
3000 Cycle Control is mounted in cubicle also containing 500 HP General Electric synchronous motor starting control.

NEW MOTORS
300 New Gen. Elect. & Westinghouse Motors in stock from 1 to 100 H.P.

100 KVA TRANSFORMERS

3—100 KVA Gen. Elect. Transformers. Type H Form KF—2400/4160 volts primary 120/240 volts secondary. Price $450.00 each. Electrically O. K. F.O.B. truck, Minnesota.

MOTORS

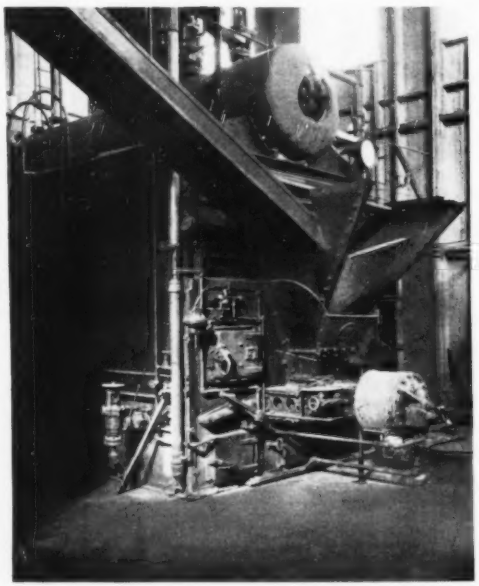
1—75 HP. Fynn-Weischel Synn. 3/60/440/1200 RPM.
1—100 Gen. Elect. Slipring Type 1 Form M., 3/60/440/900 RPM.
1—100 HP. Gen. Elect. Type K (New Motor) 3/60/440/1800 RPM.
1—100 HP Westinghouse Slipring Type CW, 3/60/440/435 RPM.
1—100 HP. West. Slipring Type CW 3/60/440/1200 RPM.
1—100 HP. Gen. Elect. Slipring 3/60/440/1200 RPM.
1—200 Gen. Elect. Type KT. 572 3/60/440/600 RPM.
1—200 HP Gen. Elect. Slipring Type I Form M. 3/25/440/500 RPM.
1—500 HP. Allis Ch. Slipring 3/60/2200/514 RPM.
1—500 HP. Gen. Elect. Type I Form K. 3/25/440/485 RPM.
1—600 HP. West. Motor Type CS, 3/25/550/490 RPM.
1—600 HP. Gen. Elect. Slipring Type MT, 3/25/550/490 RPM.

VARIABLE SPEED MOTORS

2—300/150 HP. General Electric Motors Type BTA.—3 Phase 60 cycle 440 volts 560/280 RPM with controls.

3 PHASE 550 VOLTS 25 CYCLE MOTORS
Write for our stock list of approximately 500—3/25/550 Voltmotors

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758



HIGH PRESSURE STEAM BOILER

MANUFACTURED BY ERIE CITY

300 H.P.

Complete with Westinghouse steam-driven Stoker.

Installed 1943 — in actual use less than 12 months.

Offered at less than one-half original cost.

COMPLETE — $7,500.00

WRITE . . . WIRE . . . VISIT US . . . OR PHONE HOLLY RIDGE 531

STAR LUMBER CO.
P. O. BOX 735 HOLLY RIDGE, N. C.

Star Lumber Co. is the largest carload shipper of Seasoned, Reclaimed Camp Lumber in America. Also large quantities of Allied Products including: Pipe—Electrical Equipment—Radiation—Millwork—Plumbing—Railroad Accessories—Heating Plants —etc. WRITE FOR PRICES.

"JP" FOR QUALITY EQUIPMENT

STEEL STORAGE BINS—HOPPER TYPE—1—66' long, 16' wide, 10'-6" high straight side, 6'-6" height of hopper, 6 compartments.

1—11' long, 8'-9" wide, 10" high straight side, 6'-6" height of hopper, 2 compartments.

1—88' long, 12' wide, 7' high straight side, 6' height of hopper, 8 compartments.

3—34' long, 12' wide, 6'-6" high straight side, 9' height of hopper, 4 compartments.

1—22' long, 11'-6" wide, 7'-3" high straight side, 6'-3" height of hopper, 4 compartments.

STACKS—3—5'-3" dia. x 110' high, 3/8" and 5/16" plate with reinforcing bands every 10'-8".

ABSORBER—260,000 gals., 22' dia., 90' high, vert.

STORAGE TANKS—2—Vert., 12'-6"x45', 5/16" & 1/4" plate.

AIR COMPRESSORS—8—C.P. 12" x 10" NSB, 266 CFM, 100# pressure.

GAS PURIFICATION SYSTEM—Complete with tanks, valves, piping; capacity 2,000 to 16,000 cu. ft. per hour.

PUMP—Frederick Iron & Steel Co. 8" DSV-SM, nickel iron casing, stainless steel trim, 2,500 GPM, 150' H., comp. with 125 HP, TEFC Motor and Control Panel.

AIR CONDITIONING UNITS—2—NEW CHRYSLER AIRTEMP units 75 ton complete with Trane Evaporative Condensers, Fans and Motors.

1—20 ton, Frigidaire

DIESEL GENERATOR SETS—3—G. M. Model 6-71RC, 1200 RPM, 6 cylinders, direct connected to 75 KVA Generators 3/60/127-220, complete. New 1945. Only used 100 Hours. Guaranteed condition.

3—G. M. Model 8-268A, 1200 RPM, 8 cyl., direct connected to 300KW D.C. Generators 120/240, comp. New 1942-3.

5—Superior Model GDB-8, 1200 RPM, 8 cyl., direct connected to 100KW D.C. Generators 120/240, comp. New 1942-3.

BOILER PLANT—Complete plant, Erie City, 604 HP, 180 PSI, ASME code and Natl. Board. Pulverized coal fired, with coal bin bucket elevator.

TRANSFORMERS—10 KVA G. E. 2400-240/480.

25 KVA West. 450-117 air cooled (10).

37 1/2 KVA G.E. 4600-2300 (3 avail.).

100 KVA West. 4160-208/120, 3 phase.

200 KVA G. E. Pyranol 2400-4160Y/240-120.

200 KVA G. E. Pyranol 2400-4160Y/240-480.

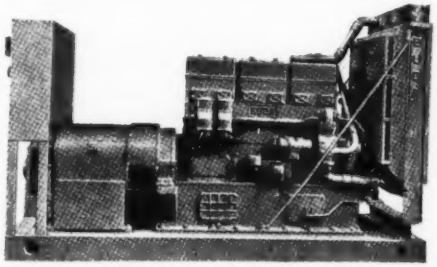
500 KVA West. 4160-480.

CONVEYORS—BELT—30", 65' centers stainless Belt with reducers & 5 HP TEFC motor.

Barber Greene complete loading conveyor, 24", 18' troughing type with rails and drive.

Heat and Power Co., inc.

70 PINE STREET | JP | DIGBY 8-0373 | JP | NEW YORK 5, N. Y.



100 KW BUDA DIESEL-ELECTRIC GENERATOR SETS

Model ARC 586-W Century Revolving Field Alternator
60 Cy, 3 Ph., 125 KVA, 100 KW, 220/127 V.
328 AMPD, 1200 RPM, 100 Field Volts, 21 Field AMPS

50 Cy, 3 Ph., 104 KVA, 83 KW, 400/230 V.
150 AMPS, 1000 RPM, 10 Field Volts, 21 Field AMPS

Powered by Buda Diesel, model 8-DCG-1125
Used approximately six months.

- *ALSO OFFERED IN EXCELLENT CONDITION:* 100 HP Westinghouse slip ring motor, complete with accessories (220 volt, 60 cycle, 3 phase, 1800 RPM)
- **300 KW MOTOR GENERATOR SET.** 1200 Amp., 440 VAC input, 440 VDC output (consists of 450 HP GE Motor & GE Generator)
- **GENERATORS—Reliance.** 15 KW, type T, DC, 125 Volt, 1800 RPM, 120 amps. Self Excitation. Driven by 25 HP, 1800 RPM 440/3/60 Motor.
- **GENERATOR—Century (Rotary Conv.).** 7 1/2 KW—AC—Type ARC, 20 volts, 78 amps, 1200 RPM, 1 phase Damper shunt wound 50° C. cont. rise, connected to G.E. mtr 15 HP, 1150 RPM, 230 VDC.

ARKO MEANS O.K.

PRODUCTS COMPANY, INC.
546 SECOND AVENUE, DETROIT 26, MICH.
WOODWARD 1-1894

SLIP RING MOTORS

3-Ph., 60 Cy.

HP	Volts	Make	Speed
450	440/220	Whse.	514
300	440/220	G.E. MTC	600
200	2200/440	G.E.	1200
200	440	G.E.	450
150	440/220	Whse. (2)	1800
150	2200/440	G.E.	1200
150	440/220	G.E.	720
125	2200/440	G.E.	600
100(2)	440/220	Whse.	900
100	2200/550	G.E.	1800
100	2200/550	G.E.	1800
50	440/220	G.E. (MTC)	900
75	2200/550	G.E.	1800
75	440/220	Whse. 25 cy.	750
50	440/220	G.E.	900

SYNCHRONOUS MOTORS

3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
240	440/220	Whse.	G	1800
200	4150/2300	Whse.	G	1800
150	4150/2300	G.	G	1800
125	440/220	Whse.	G	1200
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	440/220 (new)	Whse.	G	1800
75	2200/440	Whse.	GE	600

TURBO-GENERATOR

Generator, 62½ kva. 1200 rpm. 440/220 volt, Whse. direct connected through reduction gear to Turbine, 50 kw. 7300 rpm. non-condensing. 125/150 lbs. ga., pr.

AIR COMPRESSOR UNIT

1—13" and 8" by 18" Worthington FEATHER-VALVE, 285 rpm. 110 lbs. ga. motor-driven.

CIRCUIT BREAKERS

1—5000 amp., ITE., 3 pole, 600 v., air
2—2000 amp., GG E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampers, Whse, 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
700	2300	Whse.	CS	1800
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
350	2200/440	Whse.	CS	600
300	2200/440	Whse.	CS	600
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
200	2200/440	G.E.	KF	720
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
150	440/220	G.E.	KF	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
125 vert.	440/220	G.E.	KTP	1200
100	550	Cr. Wh.	Q	900
100	440/220	G.E.	KT	450
100	2200/440	G.E.	K	1200
100	2200/550	G.E.	KT	900
75	440	G.E.	KT	400
60	440/220 (new)	L. Allis	OGA	1800

A. C. GENERATORS

1—320 kva., 600 rpm., 440/220 v., G.E.
1—225 kva. 600 rpm., 220/440 v., G.E.
1—150 kva., 1800 rpm., 2200/550 v., Whse.
1—112 kva., 900 rpm., 440/220 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
200	230	Cr. Wh.	CMC	890
150	230 (new)	Cr. Wh.	TEFC	900
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230 (new)	Whse.	SK	1150
75	230	Whse.	SK	850
75	230	Whse.	SK	1750

MOTOR GENERATOR SETS

1—165 kw, 1200 rpm, 240 v., G.E., conn. to 250 hp, 1200 rpm, 440/220 v., squirrel cage
1—150 kw, 900 rpm, 240 v., Cr. Wh., conn. to 225 hp, 900 rpm, 2200/550 v., squirrel cage
1—125 kw, 1200 rpm, 250/120 v., G.E., conn. to 175 hp, 1200 rpm, 4000/2300/440 v., synchronous
1—75 kw., 125 v., 1200 rpm., G.E. conn. to 120 hp., 2200/440 v., syn. motor.
1—50 kw., 250 1200 rpm., G.E. conn. to 75 hp., 440/220 440/220 v., 60 cy., G.E. syn. motor.
1—60 kw., 250/1200 rpm., G.E. conn. to 75 hp., 440/220 v., 60 cy., syn. motor.

TRANSFORMERS

60 Cy.

3—2000 kva., G.E., 25000-2300 volts.
1—1000 kva., Al. Chal. 2400-120/240/208 volts, 3 ph.
1— 400 kva., G.E., 2300-230/115 v.
3— 300 kva., G.E., 13800/6900-115/230/460 v.
3— 250 kva., Whse., 2400-240/480 v.
3— 200 kva., Moloney, 2400-240/480 v.
2— 150 kva., G.E., 13800/6900-110/220 v.
1— 150 kva., Whse. SK, 13200-125/215 v., 3 ph.
6— 100 kva., G.E., 4600/2300-230/115. NEW.
3— 100 kva., G.E., 450-115/230 v., dry, 1 ph., new.
5— 75 kva., G.E., 2400-240/120 v.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—3500 KW 2300 V Cond.
1—2500 KW 600 V Cond.
1—2500 KW 2300 V Cond.
1—3000 KW 600 V Cond.
1—2000 KW 600 V Cond.
1—1500 KW 2300 V Cond.
2—1250 KW 2300 V Cond.
1—1000 KW 2300 V Non-C.
2—1000 KW 440 V Cond.
1— 625 KW 2300 V Cond.
1— 600 KW 240 V Cond.
1— 500 KW 600 V Cond.
1— 500 KW 2300 V Cond.
1— 500 KW 480 V Extrac.
1— 250 KW 2300 V Non-C.
1— 250 KW 240 V Non-C.

TURBO-GENERATORS (Continued)

1— 150 KW 2300 V Non-C.
1— 125 KW 600 V Extrac.
2— 125 KW 220 V Non-C.
1— 100 KW 600 V Non-C.
1— 50 KW 220 V Non-C.
1— 250 HP Turbine Gears
1— 375 HP Turbine Gears

ENGINE GENERATORS

2—400 KW 250 V. DC Vert. Uni.
1—375 KW 2300 V. Uniflow
1—168 KW 600 V.
1—168 KW 240 V.
1—168 KW 220 V. Uniflow
2— 96 KW 220 V. Uniflow

BOILERS

2—30,000# 425#
1—1030 HP 225#
1— 500 HP 400#
1— 300 HP 200#
1— 220 HP 160#
1— 200 HP 175#
6— 200 HP Sterling 160#
2— 190 HP 160# NEW
2— 510 HP Sterling 160#

AIR COMPRESSORS

1—6000 CFM 50# Motor
2—5600 CFM 50# Motor
1—4500 CFM 100# Motor
1—1300 CFM 100# Motor
1—6000 CFM 5.1# NEW
1—5000 CFM 10# Rotary Type Motor

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

The Buyers Must Be Satisfied—Always

SPECIAL:

New Package Steam Generators—Fully automatic.
Designed to use light or heavy oil or gas.
Complete with all auxiliaries—Ready to install.
Sizes 30 to 250 H.P. — Steam Working Pressures — 15# — 100# — 125# — 150# — Delivery early 1949.
4—400 H.P. Water tube Boilers — 225# S.W.P. *Immediate delivery.*

HOWE BROTHERS

342 MADISON AVENUE NEW YORK 17, N. Y.

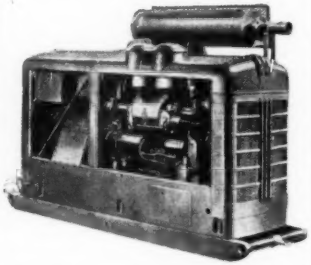
Tel. Nos. MUr. 2-8562-8563-8564

NEW

60 KW GMC DIESEL SETS

for

IMMEDIATE DELIVERY



These fully-portable, self-contained units are offered at considerably less than manufacturer's list prices.

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OTHER NEW UNITS AVAILABLE
FROM 10 KW TO 50 KW

A. G. SCHOONMAKER CO., INC.

52 Church St., New York 7, N. Y.

FOR SALE

AIR COMPRESSOR

1100 cu. ft. 100 lbs. chg. Pnu. 2 stage dir. con. 215 H.P. Westgh. Syn. Motor 2200/3/60 complete.

MOORHEAD ELECTRICAL MACHINERY CO.

Mayflower 7900 Pittsburgh 19, Pa.

DIESEL ENGINE GENERATORS

Immediate Delivery

4—Fairbanks Morse O. P. MOD 38D8⅛—1600 HP direct connected to Crocker Wheeler 1250 KVA—1000 KW—3 PH—60 CY—2300/4000 Volt—720 RPM Alternaters with 10 KW direct connected Exciters.

3—Fairbanks Morse O. P. MOD 38D8⅛—1600 HP direct connected to Fairbanks Morse 1420 KVA—1136 KW—3 PH—60 CY—2300/4000 Volt—720 RPM Alternaters with 10 KW direct connected Exciters.

8—General Motors MOD 3-268A—150 HP, direct connected to Westinghouse 100 KW—3 PH—60 CY—480 Volt—1200 RPM Generators with direct connected Exciters.

2—General Motors MOD 3-268A—150 HP direct connected to Delco 100 KW—120/240 Volt, 1200 RPM 3 wire DC Generators.

ALCO (McIntosch & Seymour) 900 HP type 6—12½ x 13—T, direct connected to GE-620 KW, 240 volt D. C.—700 RPM generators with direct connected exciters.

WALTER H. WILMS & COMPANY

2526 GUARDIAN BUILDING DETROIT 26, MICHIGAN

Cadillac 1856

AVAILABLE
FOR IMMEDIATE DELIVERY

DESIRABLE

POWER PLANT EQUIPMENT

TURBO-GENERATORS

1—6000 KVA Westinghouse 2400 V surf. cond.
1—3750 KVA G.E. 480 V. cond.
1—2500 KVA Allis-Chalmers 2300 V cond.
1—1250 KVA G.E. 480 V mixed pressure

ENGINE GENERATORS

2—675 KVA Skinner Unaflow—direct connected to Westinghouse 240/480 V gen.
1—675 KVA Allis-Chalmers full releasing Corliss 480 V
1—375 KVA Ames vertical 220/440 V
1—275 KVA Ridgeway N.R.C. 2300 V
1—187 KVA Ames vertical
1—156 KVA Ames vertical 240 V

DIESEL ENGINES

1—250 KVA G.M. 220/440 V 3 phase 60 cycle "twin" 6-71 diesel engine generating unit. New—not War Surplus.
1— 75 KVA Buda 240 V 3 phase 60 cycle generating unit. New—not War Surplus.
Also General Motors, Fulton, Fairbanks and Nordberg engines from 15 to 1000 KW.

ELECTRICAL EQUIPMENT

Large stock of Transformers, Motors, M.G. Sets, and Generators

WIRE—PHONE—WRITE
For Complete Specifications

LARGEST STOCK OF MODERN POWER PLANT EQUIPMENT ON THE PACIFIC COAST

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Mutual 9151

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

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TURBINE OF THE MONTH

1—780 KVA Westinghouse 3600 RPM 125/150 lbs. I.S.P., 2/10 lbs. G.B.P., Non-condensing 3 ph., 60 cycle, 2400 v. direct connected exciter.
Can Rebuild for 400 lbs. 700° F.

1—2000 KW G.E. 6600v, 3 ph., 60 cy. with 175 lb. cond. turbine and dir. conn. exciter.

1—1500 KW Westg. 400#, 700°F, condensing 3 ph, 60 cy. 2400 V. Surface condenser.

1—450 KW Whse 250 lbs. I.S.P. Surface Condensers—Auxiliaries—3 phase, 60 Cycle, 400 Volts. Direct connected Exciter Equipment built 1944.

2—1250 KW G.E. 2300v, 3 ph. 60 cy. with 175 lbs. condensing turbine

1—1250 KW Al Ch. 2300v, 3 ph., 60 cy. with 200 lb. condensing turbine surface condenser.

1—1000 KW G.E. 2300/4150v, 3 ph., 60 cy. with 135/150 lb. condensing turbine.

1—500 KW G.E. 480v, 3 ph., 60 cy. dir. conn. exciter with 80/100 lbs. I.S.P. 10/15 lbs. B.P., non-condensing turbine.

2—500 KW G.E. 2400 v, 3 ph., 60 cy. dir. conn. exciter, 175 lbs. I.S.P. 10/15 lbs. B.P. non-cond.

BELYEA COMPANY INC.

43 HOWELL ST. JERSEY CITY 6, N. J.
Phone—Journal Square 2-3334
ALSO N. Y. CITY LINE—RECTOR 2-7150

WURTH for "WORTH"!

A. C. GENERATORS 3 PHASE—1 PHASE 15 to 62½ KVA

LARGEST STOCK OF A.C. AND D.C. MOTORS FROM 5 TO 200 H.P.
D. C. MOTOR GENERATOR SETS TO 75 KW • HIGH CYCLE GENERATORS
Send for Our Latest Stock List

WURTH ELECTRIC MOTOR COMPANY
Motors, Generators, Alternators, Frequency Changers
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BERGER OFFERS

Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGERS SETS

MOTOR GENERATOR SETS
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TRANSFORMERS LARGE STOCK
D. C. GENERATORS ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES, VOLTAGE AND CYCLES

3 ph. 60 cy. A. C. Motors
3 ph. 25 cy. Motors
125 Volts D. C. Motors
230 Volt D. C. Motors
550 Volt D. C. Motors

WRITE OR WIRE YOUR INQUIRIES

BERGER BROTHERS Electric Motors, Inc., 395 STATE ST., ROCHESTER 4, NEW YORK

PUT ALL IDLE EQUIPMENT TO WORK. SEND YOUR LIST FOR PROMPT ACTION.

850C.F. M. DUPLEX AIR COMPRESSOR

12"x14", 100 P.S.I., Center Drive Flywheel, Lubricator, Unloaders

1—2000 GPM 150 PSI 8" Centrifugal Pump with direct coupled 240 HP Steam Turbine on base.
1—6000 GPM 16" Centrifugal Pump.
3—750 and 1000 GPM Knowles Steam Pumps & other sizes.
1—14" Roots Blower & other sizes.
21—Air Compressors, various cap.
2—375 CFM Worthington 12" x 9" horizontal Vac. & Press Pumps.
5—2000-5000 GPM 32'-65' hd. 10" & 12" Kingsford Cent. Pumps.
11—Nash Vac. & Cond. Return Units.
375—Rebuilt Elec. Motors 1-200 H.P.
4—Kinney unused, 6" Rotary Pumps.
98—Exhaust Blowers & Fans.
17—Triplex Pumps, various sizes.
9—Nash 1/2 0, 0, 1, 2 wet vac. pumps.
3—Blackmer Rot. 6" pumps 500 gpm.
1—Norwalk 4-stage Compressor 28 CFM, 5000 PSI, 20 H.P. Motor.
1—GE Turbo Blower 2-st. 3000 cfm, 16 psi. Also 1-st. 3000 cfm, 8 psi.
1—#70 Buffalo paddle wheel Blower.
1—Hydr. Triplex Pump 2-st. 3000#.
26—Spencer Turbines 35-4000 CFM.
33—Asstd Engine dr. Pumps & MG Sets.
70—Various Port. & Stat. Agitators.

SUPERIOR EQUIPMENT CO.
136 GRAND ST., N. Y. C. CA nal 6-6983-4

FOR SALE — BOILER

565 HP Water Tube Boiler. Springfield. 160 lbs. pressure. 5650 sq. ft. heating surface. 3 Firelte stokers. Forced draft fan. Boiler feed pump. Coal elevator and bunker. ashbunker.

CHICAGO ELECTRIC CO.
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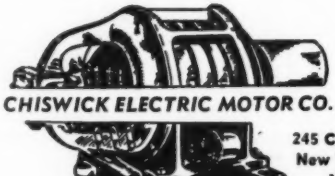
MOTORS • CONTROLS • GENERATORS

Rebuilt Guaranteed Equipment in Stock

SIZES FROM 1 HP TO 250 HP



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245 Centre St.
New York 13, N. Y.
Digby 9-1744

SPECIAL OFFERING

New 450 HP Enterprise, Diesel Engine, Model DSG 6, 450 RPM, 6 cylinder, 4 cycle, air starting, solid injection.

ALJOHN DIESEL CO., INC.
904 Pacific Street Brooklyn 16, N. Y.
Sterling 3-6515

COMPRESSORS—VACUUM PUMPS

NEW and GUARANTEED REBUILTS

SPECIALS

22 x 9 Ingersoll Rand, ES Vacuum Pump 1183 CFM
9/4 x 9 Ingersoll Rand, ES2, 191 CFM 350 LBS
9-10 x 9 Ingersoll Rand, FS1, 242 CFM 75 LBS
10 x 9 Ingersoll Rand, ES1, 262 CFM 75 LBS

Any Make—Any Size—We Can Help You, Portable or Stationary

American Air Compressor Corp.
Dell Ave. and 48th St., North Bergen, N. J.

TRANSFORMERS

1 KVA up to 200 KVA in stock

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St. Phila. 34, Pa.
Phone Ga. 5-0488

ASME BOILERS Nat'l Bd.

2—104 HP sectional steel header cross drum Springfield, 10' settings, oil fired.
2—25,000# (normal rating) Stirling's pulverizers, 425#.
2—400 HP sectional header, underfeed stokers.
1—300 12' settings, 7 years old, stack & breaching for these 3 units.

H. P. BREARLEY
3423-91st Street Jackson Heights, N. Y.

FOR SALE

100, 125, 150, 250, 350 HP Motors—New & Used
6 ft. x 80', 129' or 130' Kilns—complete
2—NEW B&W Boilers—425 & 600 HP—H.I.P.
400 KVA 220/440 V. Gen. dir. con. Engine
300 KW 125/250 V. dir. cur. eng. gen. set
60'x200' NEW Structural Steel Building

H. & P. MACHINERY CO.
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FOR SALE

CROCKER WHEELER MOTOR

300 HP, 230 Volts D.C., 500 RPM, Type CCM, Size 108DA, complete with Starting Control Panel.

ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th St. Philadelphia 22, Pa.

Most all units still on foundation. Many may be seen operating

TURBO UNITS (NON-COND)

625 KVA General Electric 2300/480 v.
625 KVA Al. Chal. 480/240 v.
375 KVA (2) General Electric 2300-480 v.
250 KVA General Electric 600 v.
187 KVA General Electric 3-60-440/220 v.
125 KVA GE 240/480 v.—Moore 250#
115 KVA Wghse. 2400/480 v.—Sturtevant
62.5 KVA GE 240/480 v.—DeLaval
62.5 KVA GE 480/240 v.—Terry 310#

TURBO UNITS (COND.)

1875 KVA (2) General Electric 2300 v.
1250 KVA Wghse. 2300 v.. 425#
1250 KVA General Electric 2300 v.
1250 KVA (2) Al. Chal. 4000/2300 v.. 300#
750 KVA General Electric 240/480 v.
2500 KVA General Electric 2300 v.
937 KVA GE 2300 v. (mixed pres. 140#-16#)

DIESEL UNITS

375 KVA FM "32E-14"; 480/240 v.
250 KVA Elliott 240/480 v.—Buckeye
125 KVA Elliott 240/480 v.—Buckeye
156 KVA Ideal 240/480 v.—Buckeye
112 KVA Fairbanks Morse 32D-14
109 KVA GE 240/480 v.—Superior
93.8 KVA EM 480/240 v.—Superior
37½ KVA (3) General Motors 220/440 v. (NEW)

BOILERS

605 HP Union 3 drum 200#
508 HP Combustion 200#
507 HP Combustion 400#
469 HP Sterling 425#
312 HP Sterling 180#
298 HP Keeler Cross Drum 200#
288 HP Combustion HRT 150#
255 HP Sterling 3 drum 170#
250 HP Erie City (Heine) 180#
200 HP (2) Vogt 160#
200 HP Erie City 3 drum 160#
125 HP (2) Scotch Marine 100#
110 HP Erie City 3 drum 160#
102 HP Ames (Economic) 125#

STEAM ENGINE SETS, A. C.

1125 KVA GE 480/240 v.—Nordberg Unif.
400 KVA GE 2300/480 v.—Erie City poppet v.
312 KVA GE 2300/480 v.—Chuse 4 v.
210 KVA GE 480/240 v.—Skinner
187 KVA GE 480/240 v.—Chuse 4 v.
187 KVA GE 2300 v.—Chuse 4 v.
150 KVA GE 240 v.—Skinner

SPECIAL

187 KVA Wghse. 3-60-240 v.; dir. con. 3 cyl. vertical Ames Uniflow engine complete

STEAM ENGINE SETS, D. C.

600 KW Wghse. 250 v.—Skinner Uniflow
300 KW GE 250 v.—Skinner Uniflow
300 KW CW 125 v.—Skinner Uniflow
200 KW GE 125 v.—Skinner Uniflow
150 KW GE 125 v.—Skinner Uniflow
150 KW CW 250 v.—Ames Uniflow Vertical

POWER PLANT EQUIPMENT CO., INC. 39 Cortlandt St. New York, N. Y.

HEADQUARTERS for GEARMOTORS

Brand New G.E. and U.S. 3 Phase 60 Cycle 220/440 Gearmotors in Stock

Guaranteed for One Year

8 — ½ HP 84 rpm
13 — ⅜ HP 190 rpm
3 — ¾ HP 20 rpm
10 — ¾ HP 190 rpm
5 — 1 HP 37 rpm
7 — 1 HP 160 rpm
3 — 1 HP 190 rpm
10 — 1 HP 280 rpm
2 — 2 HP 16.5 rpm
4 — 2 HP 37 rpm
10 — 2 HP 190 rpm
2 — 2 HP 230 rpm
9 — 3 HP 45 rpm
3 — 3 HP 190 rpm
3 — 3 HP 350 rpm
2 — 5 HP 155 rpm
8 — 5 HP 230 rpm
6 — 7½ HP 13.5 rpm
6 — 7½ HP 420 rpm
1 — 10 HP 100 rpm
3 — 10 HP 125 rpm
3 — 15 HP 350 rpm
1 — 20 HP 100 rpm
1 — 60 HP 56 rpm

ABOVE MOTORS IN STOCK

Can ship unlisted gearmotors 1 to 25 HP in 2 to 4 weeks, practically all ratings. Also, good stock of rebuilt gearmotors from ½ HP to 40 HP

Prompt Detailed Replies to All Inquiries

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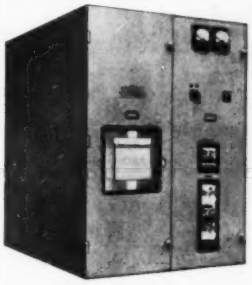
NEW ENGLAND'S LEADING MOTOR DEALER
166 Oliver St. Boston 10, Mass.



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GENERATOR CONTROL
INDUCTION MOTOR FULL VOLTAGE STARTING
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New! GENERAL ELECTRIC
VERTICAL LIFT TYPE M1-6 SWITCHGEAR

9 UNITS incorporating
GE Type FK255-500 . . . 2000 Amp . . 15000 Volt . . . 250 Volt DC Solenoid Operated Breakers.

4 UNITS incorporating
GE Type FK255-150 . . . 1200 Amp . . . 15000 Volt . . . 250 Volt DC Solenoid Operated Breakers.

49 UNITS incorporating
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ELECTRICAL EQUIPMENT
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Rebuilt and Guaranteed

2—Warren 20"x16", Size 20, Type 16DL 8500 GPM, 45' Head, complete with 125 HP 440/3/60 870 RPM Motors.

1—Dayton-Dowd Type CSLH 10"x10", 2000 GPM, 118' Head, complete with 75 HP 440/3/60 1800 RPM motor.

1—Dayton-Dowd, Type CSLH 10"x12", 3000 GPM, 130' Head, complete with 125 HP 440/3/60 1800 RPM motor.

2—Dayton-Dowd, Type CSLH 12"x14", 5000 GPM, 130' Head, complete with 200 HP 440/3/60 1800 RPM motor.

3—Goulds All-Bronze 4"x3" 2-stage 400 GPM 150' Head 1750 RPM, 25 HP 1750 RPM motor.

1—Allis-Chalmers Type S all Bronze 6"x5" 1000 GPM, 230' Head, 100 HP 1750 RPM motor.

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4000 KW TURBINE GENERATING PLANT

Consisting of

1—2000 KW and 2—1000 KW General Electric, 3 phase, 60 cycle, 480 Volts, 3600 R.P.M. Condensing Turbo Generator Units. Complete with all Auxiliaries. General Electric inspection reports are available.

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MOTOR GENERATOR SETS
ALTERNATORS, ALL FREQUENCIES
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D. C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
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125 Volts D. C. Motors
230 Volts D. C. Motors
550 Volts D. C. Motors

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Put all idle equipment to work. Send your list for prompt action. WRITE OR WIRE YOUR INQUIRIES

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60 CYCLE — 1 PHASE

3—25 KVA Niagara O.I.S.C. 2400/4160Y-120/240.
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3—37½ KVA Niagara O.I.S.C. 2400/4160Y-120/240.
3—37½ KVA Niagara O.I.S.C. 2400/4160Y-240/480.
3—50 KVA Niagara O.I.S.C. 2400/4160Y-120/240.
3—50 KVA Niagara O.I.S.C. 2400/4160Y-240/480.
3—75 KVA Niagara O.I.S.C. 2400/4160Y-120/240.
3—75 KVA Niagara O.I.S.C. 2400/4160Y-240/480.
3—100 KVA Niagara O.I.S.C. 2400/4160Y-120/240.
3—100 KVA Niagara O.I.S.C. 2400/4160Y-240/480.
3—150 KVA Niagara O.I.S.C. 2400/4160Y-240/480.
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All transformers listed for February Stock Shipment—Short delivery on sizes from 25 KVA to 5000 KVA, 1 or 3 phase in voltage ratings to 40 KV.

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ERIE ELECTRIC CO., INC.
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COMPLETE 2500 KW STEAM POWER PLANT

consisting of two, 1250 KW 3-phase 60-cycle, 2300-volt, Allis-Chalmers turbo-generators with control panels, condenser, boilers, economizers, super-heaters, feed water regulators, pumps, piping, induced-draft fan, direct firing coal pulverizers with bin and stand-by fuel oil burning equipment. All equipment complete with motors and controls where required. In excellent condition and now available.

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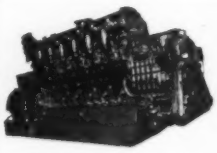

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HEMCO

1000 KW, 2400 Volts, 3 Phase, 60 Cycle, 720 RPM, General Motors Model 16-278A.
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300 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A.
200 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A.
50 KW, 440 Volts, 3 Phase, 60 Cycle, 900 RPM, Fairbanks-Morse Model 36A 5½.
100 KW, 3 Wire, 125/250 Volts DC, 1200 RPM, General Motors Model 3-268A.
900 HP, General Motors Model 12-567, Propulsion Unit Complete.

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5 KW. TO 1000 KW.
NEW-USED
RECONDITIONED

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50,000 lb. Integral Furnace 400 lb. B & W boiler superheater air heater pulverizer fans accessories
2500 KW 2400 volt GE Cond. turbine unit.
1500 KW 480 volt GE NonCond Turbine set.
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200 KVA 480 volt Ridgway 4 valve engine set.
200 KW G. E. M. G. Set 2200 AC 250 DC.
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6—74,000 & 35,000 Bbl. Vertical
2—10,000 & 3—3,000 Bbl. Vertical
6—10,000 & 3—20,000 Gal. Horizontal

DARIEN CORP.
60 E. 42nd Street, New York, N. Y.

1 GE 144KW vert. alternator 3 phase 60 cycle 240 V 120 RPM for 8-12' head with Smith turbine and 3000 lb. Woodward governor $5000.
1 225 KW vert. unit for 16-22' head complete with governor $5500.
1 168 KW vert. 2300 volt 9-14' head $5700.
1 250 KW vertical unit 2300 volt for low head. Write for data.
1 80 KW 2300 volt complete only $3500.
2 Leffel scroll wheels for 150-250' head.
2 Pelton type for heads up to 800'.

Low prices for many others. All subject to prior sale.

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IMMEDIATE SHIPMENT!

650 H. P. Casey Hedges Boiler 225 PSI
250 H. P. Casey Hedges Boiler 225 PSI
100 H. P. Locomotive Firebox Boiler 120 PSI
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ALL BUILT 1942-43

Two 80 HP. Erie Economic 125 lb.
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Two 100 HP. Hamburg V.T. 125 lb.
above Boilers in use 2 yrs.
Also other types & sizes in stock.

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25 cy. 60 cy. D.C.
ALL VOLTAGES
1-1500 H.P.
NEW and REBUILT
BOUGHT and SOLD
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N.Y.

DIESELS

Two (2)—900 H.P. at 700 RPM. Mfr.—Maschinen Fabrik Augsburg—Nurnberg (M.A.N.) Complete with Auxiliary Equipment.

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Twelve (12)—12.5 KVA 230/400 volts — 50 cycle International Harvester—Marble Card.

One (1)—100 KW D.C. 230 Volt—423 Amp. at 900 RPM 230 Volt—350 Amp. at 750 RPM. M.A.N. Diesel—6 cylinder.

TURBO-GENERATORS

Four (4)—250 KW A.C. plus 40 KW D.C. 250/450 V 3 phase, 60 cycle or 200 KW plus 30 KW D.C. 220/380 V—50 cycle Mfg. by General Electric Co.

Two (2)—300 KW D.C. 120/240 volt 6 Pole—3 wire—Comp. Wound Turbine by Worthington Moore. Generator — Allis Chalmers.

Two (2)—300 KW D.C. 120/240 volts. Comp. Wound Turbine by J. Handy. Generator—Westinghouse.

This Equipment in Original Crates

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2—Cameron, Size 8 LFV, 2800 GPM. 90 ft. head at 1775 RPM, Hydro Test 100—10" inlet, 8" outlet. Mfr. Ingersoll Rand. Equipped, Motor 75 HP G.E. 3-60, 220/440—Used—condition equal to new.

10—Dayton Dowd Centrifugal Pumps. Type A. Capacity 230 GPM. 224 ft. head, 3500 RPM. 3" flange section, 2½" discharge. Direct Connected to Louis Allis 20HP, 230 Volt D.C. motor. Pumps are new, priced at 50% of cost.

5—Baldwin Southwork, Horizontal Triplex Hydraulic Pumps. 500 GPM at 1500# pressure 5⅛"x18" Stroke—Motors 500 HP 3 Phase 60 Cycle 6600 V 506 RPM.

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1657 St. Clair Cleveland, Ohio
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MOTOR-GENERATOR SETS

3 Phase—25 Cycle

1000 KW G.E. Type MCF, 250 V DC, 4000 Amp., 750 RPM self-excited Generator direct connected 1400 HP Type ATI, 3/25/2200, .8 P.F. Synchronous Motor. 2 unit 3 pedestal bearing common bedplate. Complete switchgear.

3 Phase—60 Cycle

200 KW West. Type SK, Shunt Wound 250 V DC, 850 RPM Generator, 250 HP Type CS, 3/60/2300, 850 RPM Induction Motor, Exciter, Rototrol Generator, Unit Frame construction, Rototrol Control.

MOTOR

200 HP West. Type SK, Frame 210, Style No. 78M717, 230 V DC, 575 RPM with Magnetic Starter.

TRANSFORMERS

Singe Phase—25 Cycle

6—250 KVA West. O.I.S.C., 2300/230/460, 4—2½% taps, 3.5% Impedance.

Single Phase—60 Cycle

3—250 KVA West. Type SL, O.I.S.C., 2300/230/460, 4—2½% taps, 5.0% Impedance.

PLANER DRIVE

30 KW West. direct connected Induction M-G set, 220/440, 250 V DC, 35 HP Type SK, Frame 141, 230 V DC, 200/1200 RPM Motor, Planer Control Panel, Rheostat, Limit Switches.

CENTRIFUGAL PUMP

Worthington Type 4-XU-2, 6 stage, 600 GPM, 1250 PSI, complete with 500 HP, 440/3/60, 3460 RPM Motor and control.

Complete Information on Request

DELL STEPHENSON & CO.
2565 GUARDIAN BUILDING Cherry 7392 DETROIT 26, MICH.

1060 KVA — IMMEDIATE DELIVERY — 850 KW

TWO NORDBERG DIESEL GENERATING UNITS

MAY BE SERVING YOU ONE MONTH AFTER SITE PREPARED

- Moderate Price—includes Nordberg inspection with generous parts replacement and reconditioning.
- Guaranteed by NORDBERG—one of America's oldest and largest builders of Diesel engines.
- Save Money—Burn cheapest, low grade fuel oils available.
- Low Speed—Heavy Duty—Durable—Reliable Low Cost Operation.

These 1060 KVA units are available because of replacement by larger Nordberg Diesels.

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NORDBERG MFG. COMPANY, MILWAUKEE, WIS.

COMPLETE BOILER PLANT AND ACCESSORIES

The following equipment, installed in 1929 for blast furnace blowing engines and actually operated but four years, location Holt, Alabama, now for sale, where is as is, immediate delivery:

Two D Connally Boilers, 380 HP each, approved steam pressure, 200 pounds gauge. Each boiler has four foot by one hundred fifty foot stack. The boilers are equipped with Copes Feed Water Regulators, and all instruments necessary for efficient operation. The boilers are equipped with two Cox stokers, made by the Combustion Engineering Corporation, and are in excellent condition. An American Blower, size 5, type HS, No. 2678 is used for force draft for these stokers.

Two Reciprocating Worthington Boiler Feed Pumps are furnished, size 14"x8½"x15".

The boilers are not equipped with Super Heaters.

All steam piping is included inside the boiler house.

A Skip Hoist, for hoisting fuel, is also furnished, and is in excellent condition.

Two fuel bins, steel construction, are available, one for each stoker.

The boiler house construction is of all steel, and corrugated iron sheeting; approximate size 60 x 60 ft.

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BIRMINGHAM 3, ALABAMA
(Phone 3-9135)

A C STEAM GENERATING PLANT FOR SALE

1—250 KW, 240 volt, 3 ph. 60 cy. 180 RPM Ridgeway Alternator #395, Design #60501
1—400 HP, 22" bore x 24" stroke Ridgeway Engine #3461
1—15 KW, 120 Amp. 125 volt, 1200 RPM Ridgeway Exciter #2274, belt drive
On foundation, Topeka Water Dept., **$5500**

PORTER ELECTRIC COMPANY
330 S. 6th St. Minneapolis, Minn.
Lincoln 7531
ELECTRICAL EQUIPMENT COAST TO COAST

SURPLUS ELECTRICAL EQUIPMENT

2—2100 HP, GE Synchronous motors. 514 RPM, 4600/2300 V, 3 phase, 60 cycle, 80% P.F. Complete with rheostats and belted exciters. Full details on application.
2—2000 KVA Transformers—Single phase 60 cycle, 69/34.5 KV to 4800/2400 V. Westinghouse O.I.S.C.
1—3500 KVA—3 phase, 60 cycle, 33/13.8 KV Westinghouse Transformer.
1—600 A., 3 P.S.T., 34.5 KV Outdoor O.C.B. Westinghouse CO-1-A.
1—3 pole, 600 A, 34.5 KV Outdoor Disconnect Switch.
Miscellaneous Distribution Transformers, Cable, Switches, Potheads and Electrical Instruments. Also Ross Carrier—hardly used. Arch measurements—91" high and 76" wide. 7 Ton capacity.
All the above are for immediate sale and are located at our Pulp Mill on Vancouver Island.

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Turbo-Generators: GE 500 KW sur. cond. & piping $1,950; GE 300 KW cond. complete plant $8,500; ditto Wghse. 1000 KW $24,750; ditto Al-Chal. 1250 KW $15,000.
Compressors: I-R model 315A port. all engine dr. excel. cond. $2,850; New Worthington 60 & 80 CFM @ 150# AC motor dr. centrols, dual receivers & intercooler $995 & $1295.
Blowers: New Buffalo Forge 8000 CFM GE Motor 6/1.8 HP. 1750/1150 RPM, 3/60/440 $250; ditto 16000 CFM 15/5 HP, 1770/1175 RPM, 3/60/440, $350.
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200 HP ELECTRIC MOTOR

Westinghouse 440/220 v, 227 amp, CCL Induction Constant Speed, 1150 rpm full load, 3 phase 60 cycle. With starter box, good condition, $1500.00.

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100 H.P. AMES ECONOMIC ASME 125 LB. PRES. BOILER 60 FT. STACK & GRATES

DARIEN CORP.
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STEAM TURBINE

One low pressure 680 H.P. Worthington Moore Steam Turbine for one lb. per sq. inch steam pressure and 26 in. of vacuum. Speed up to 3600 RPM, Serial No. 5210.

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2—Ingersoll-Rand Air Compressors. Class ER-1, 20"x12"
2—Baldwin Diesel Engines, Model V-0-8, 1000 H.P. 625 R.P.M. Bore 12.75 stroke 15.5 Serial #2403, 2404. Built in 1945. R.H. Woodward Governors.
1—125 HP, 440 V slip ring Crocker Wheeler Motor. 575 RPM.
76—½ HP, single phase, 180 to 2700 rpm MASTER Speed rangers.
1—400 HP syn. motor, 2300 V with starting equipment.

Large selection of all types of motors on hand for speedy delivery

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FOR SALE
NEW WATERTUBE BOILERS INTEGRAL FURNACE,
STOKER OR OIL

1—25,000#—250# Design
1—20,000#—250# "
1—15,000#—160# "

IMMEDIATE DELIVERY
Automatic Combustion Eqpt. Co., Inc.
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Erie City HRT Boiler, 165 H.P., 125# working pressure. Complete with Petro oil burner, W. N. Best steam atomizer oil burner, two steam feed pumps, stack. Excellent condition.

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1—2500 KW 3/60/2300 G. E. condensing turbo-generator 165 P.S.I. (can be changed to 400 P.S.I.). Complete auxiliaries.
1—1250 KW 3/60/2300 Allis-Chalmers condensing turbo-generator 165 P.S.I. Complete auxiliaries.
1—750 KW 3/60/2300 G. E. condensing turbo-generator 165 P.S.I. Complete auxiliaries.
4—Whitlock Type R fuel oil heaters 14,000 lbs./hr. with 185 lbs. steam.
2—New C. H. Wheeler, 720 sq. ft. shell and tube condensers 20" inlet.

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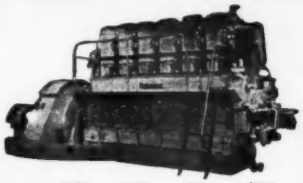
NEW ENTERPRISE DIESELS

450 HP
450 RPM
Model DSG-6



375 KVA
300 KW
AC STD VOLTAGES

Qu.	HP	Model	RPM	KVA	KW	GEN.	Ph.	Cycle	Volts
3	1600	General Motors 16-278A	720	1250	1250	General Elec	3	60	2300
2	1600	General Motors 16-278A	720	1250	1000	Elliott	3	60	2400/4160
*1	500	Fairbanks Morse Type Y	257	415	415	Fairbanks Morse	3	60	2400
**3	450	Enterprise DSG-6	450	...	250	Elliott	..	DC	120/240
1	300	Buckeye Model E	400	250	200	Elec. Mchnry.	3	60	240
1	225	Buckeye Model E	400	187	150	Ideal	3	60	240
**3	125	General Motors 6016-E	1200/1000	75/62.5	60/50	General Elec.	3	60/50	127/220-230/400
1	100	International UD-18	1200	62.5	50	Westinghouse	3	60	240
**1	90	General Motors 6-71	1200		60 KW	Delco DC			120/240
**2	52	International UD-14	1200/1000	37.5/32.5	30/25	Elec. Mchnry.	3	60/50	127/220-230/400
**8	36/30	International UD-9	1200/1000	23/18.75	18.75/15	Elec. Mchnry.	3	60/50	240/440/127-220
1	79	Caterpillar D4600	1200	37.5	30	Ideal	3	60	220

* One plant Consisting of Three Units, i.e. 65, 150, and 200 KW.
** New units (all other units used).

Diesel Motors — "We Help To Light And Power The World"

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10 to 1000 H. P.
NEW-USED RECONDITIONED
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COMPLETE POWER PLANTS

STEAM-ELECTRIC-HYDRO-DIESEL *"Export Orders Carefully Executed"*

BOILER UNITS

1—100,000# Steam Generator 600#
2—60,000# Steam Generators 450# or 200#
2—30,000# Steam Generators 450# or 200#
4—1000 HP Heines with superheat 200#
2— 825 HP B&W Co. Stirlings, Super, 200#
2— 500 HP B & W Co. Stirlings, 160#
2— 600 HP B&W Co. Sectional, Super 350#
2— 450 HP B&W Co. Sectional header 200#
3— 310 HP Stirlings 180#

TURBO-GENERATORS

1—7500 KW Unit Condensing 525#
1—6000 KW Unit Condensing 235#
1—5000 KW Unit Condensing 235#
2—5000 KW Units Condensing 200#
1—4000 KW Unit Condensing 200#
2—2500 KW Units Condensing 200#
2—2000 KW Units Condensing 200#
2—1500 KW Units Condensing 200#—one bleeder
2—1250 KW Units Condensing 200#
Several 1000 KW, 750 500 KW Cond.
Non Cond. 300-500-750-1000-1500-2000-2700 KW

FIRE TUBE BOILERS — Various Types and Sizes. TRANSFORMERS, MG SETS
FREQUENCY CHANGERS—600, 1250 & 1500 KVA.

CHARLES B. REARICK **30 CHURCH ST., NEW YORK 7**

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IMMEDIATE DELIVERY

2—300KW Buckeye Diesel Generator Sets
1—200KW Buckeye Diesel Generator Set
1—175KW Buckeye Diesel Generator Set
1—125KW Buckeye Diesel Generator Set
2—100KW Buckeye Diesel Generator Sets
3—75KW Buckeye Diesel Generator Sets

Also, several 60, 80, 100, 112½, 150 and 187½ HP Engines for belt drive.

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8— 15 KVA. 60 CY. 1 PH. 2400-480/240.

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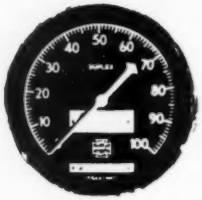

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COMPLETE WITH CONDENSER, CIRCULATING,
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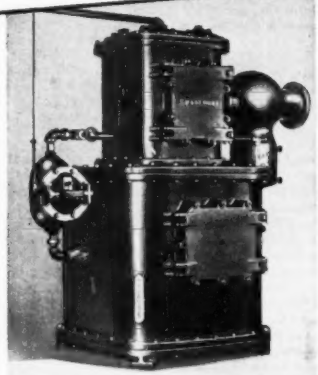

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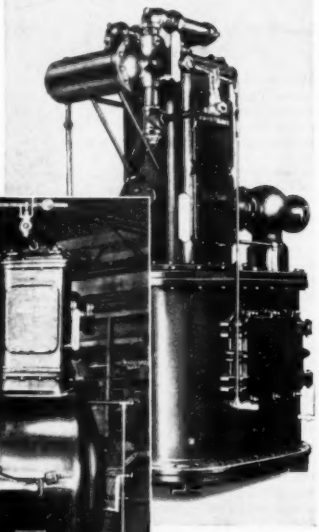

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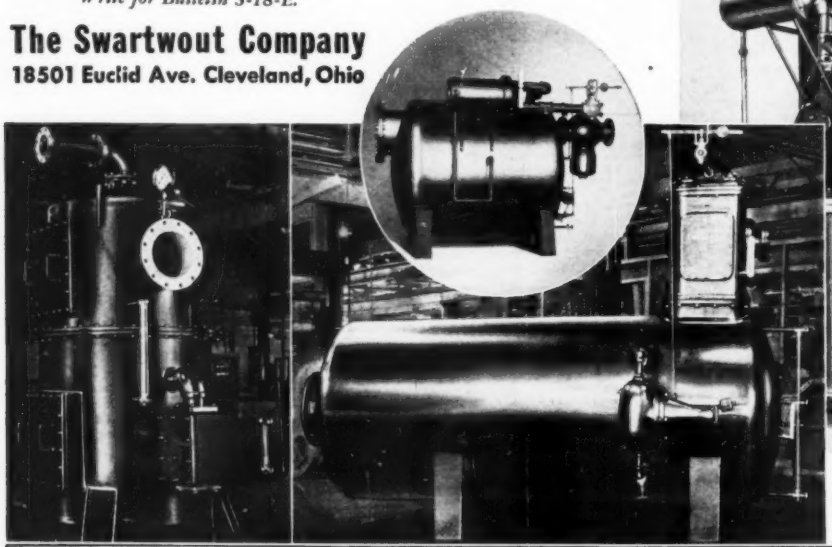

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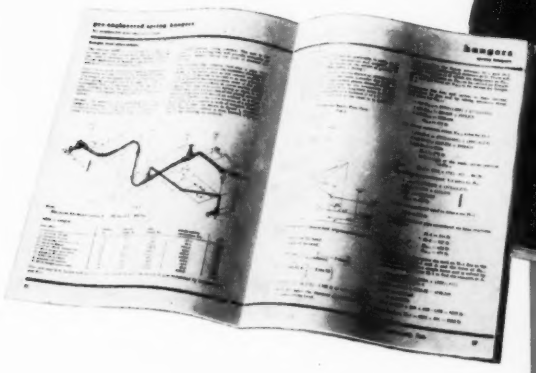

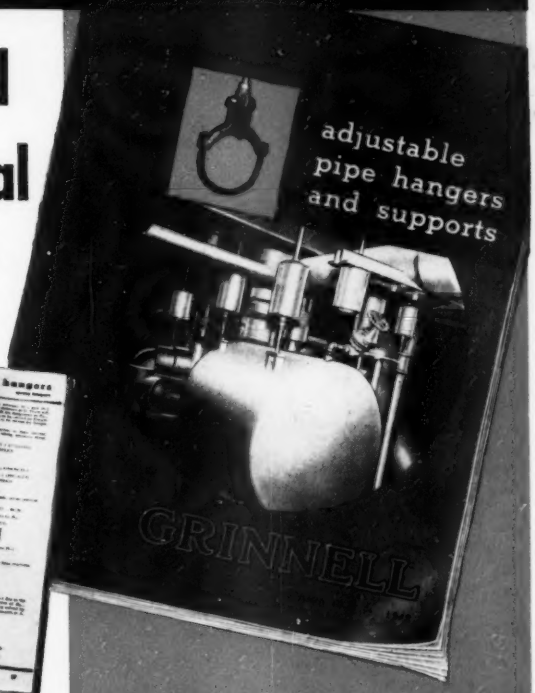

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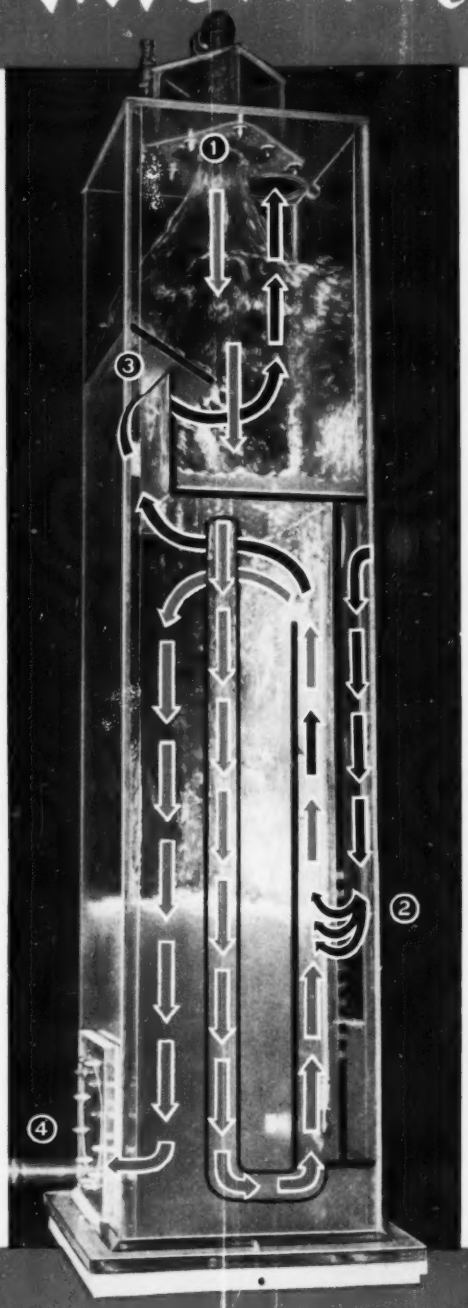

1 FIRST STAGE. Cold water, entering here, is heated almost to steam temperature by *spraying* it through steam. This removes 95% of the oxygen. The water then travels downward through the pipe toward the second stage.

2 SECOND STAGE. Here the partially deaerated water is intimately mixed with steam entering through the scrubber. Violent boiling and vigorous scrubbing is assured for both light and heavy loads, and deaeration is completed.

3 The steam from the scrubber travels upward and enters the first stage of the heater, where it partially deaerates incoming water. The remaining steam is then vented to the atmosphere.

4 Here the completely deaerated water settles and may be drawn off. Ample water storage space is provided below the water control level.

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